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Tolerances for Large Diameters

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Standards on small diameters and bores have been established by the International Standards Association, but limits for the larger sizes are still unsettled. Because of the meeting of the association at Milan, Italy, in June, Professors Sawin's recommendations on this subject are particularly timely

IS IT permissible to claim that the true dimensions of work inspected by limit gages are always within the limits of these gages, provided that the gaging is performed strictly according to the rule: "go" and "not-go"? Two series of experiments carried out in 1930-31 will be described here with the view of elucidating this question.

1. Six different shops produced shafts and holes to fixed limit gages of the international or ISA system, that is: Shafts 35 and 75 mm. diameter to gages j_6 and k_6, holes of the same nominal diameters to gages H_7 and K_7. Tolerances are given in Table I. All pieces, totaling 210, were checked carefully in one inspection room. Their dimensions were actually in 30 per cent of all cases partly outside the prescribed limits. This was mostly because of deviations from exact geometric shape. Nothing is known concerning the conditions of inspection, nor about the state of the gages, but it may be surmised that the inspection was performed under average shop conditions.

TABLE I — ISA tolerances in μ for test diameters

	35 mm.	75 mm.
H_7	+ 25	+ 30
	— 18	— 21
K_7	+ 7	+ 9
	+ 11	+ 12
j_6	— 5	— 7
	+ 18	+ 21
k_6	+ 2	+ 2

μ = 1 micron or 0.001 mm.

Forty-two per cent of the shafts were more exact than required and corresponded to ISA gages j_5 and k_5. Forty-three per cent of the bores had tolerances corresp onding to grades H_5 and K_5.

2. Seven shops of a large concern produced shafts and holes to fixed limit gages of the ISA system, that is: shafts 25 and 60 mm. diameter to gages j_6 and h_7 and holes of the same nominal diameters to gages H_6 and H_7. Material and machining was specified. After finishing the work, the piecework rates were compared. The tolerances are given in Table II.

TABLE II — ISA tolerances in μ for test diameters

	25 mm.	60 mm.
H_7	+ 21	+ 30
H_6	+ 13	+ 19
h_7	— 27	— 30
	+ 9	+ 12
j_6	— 4	— 7

All gages and pieces were checked carefully in one inspection room. In order to determine deviations from correct geometric shape, both shafts and holes were checked at three spots along their axes, and on two diameters at right angles to each other. The results, totaling $168 \times 6 = 1{,}008$ measurements, were compared with the actual dimensions of the gages used during production. About 12 per cent of all cases, because of deviations from correct geometric shape, were partly outside the specified tolerances. An examination of the gages showed that they were correct and that the deviations

from correct geometric shape were not caused by their inaccuracies.

It may be added that the ground shafts and holes were geometrically correct, but the holes finished by means of reamers were considerably out of round and tapered. In spite of these deviations from limit gages, interchangeability was satisfactory, and the properties of the fits $H_7\ h_7$ were better preserved than those of the fits $H_6\ j_6$. This however, was to be expected because of the closer tolerances of the first-named fit.

Reference is also made to the remarkable work of K. Gramenz concerning selection of tolerances entitled "Investigations on Work Concerning Precision with View to Determine Appropriate Fits." As the title indicates, this investigation was made to decide whether or not fits selected by design or shop considerations were too close.

The differences between the dimensions of the work and the limit gages were also determined. The average number of deviations beyond the limit gage tolerances amounted to 65 per cent on shafts and 25 per cent on holes. In both cases, the diameters were within 14–150 mm. These figures, derived from experimental data of some years ago would, of course, be lower today because no properly managed shop would now tolerate such numerous deviations. Nevertheless, it may be surmised that occasionally, even with modern measuring technique, partial deviations from specified tolerances occur.

From the three series of experiments, it could be concluded that the true dimensions of work of small and medium diameters are within the limits of the specified tolerances, yet there is no absolute guaranty that this is so. Occasional deviations, mostly caused by out-of-roundness, have no influence on the usefulness of the work. Likewise, available experimental data lead to the surmise that these deviations are more numerous with larger diameters.

Large Work a Different Problem

When limit gages of the international system for different grades of smaller diameters up to 180 mm. were being established, every possible consideration was paid to the conditions of use of fixed limit gages in quantity production and to their wear, accuracy of manufacture and errors in measuring. The tolerance experts participating in the establishment of the ISA system, in view of the enumerated facts, have considered that work up to 180 mm. measured with limit gages has its true dimension within the limits of the "go" and "not go" side. However, work having diameters over 500 mm. and up to 3,000 mm. is different.

When proposing limit gages for such diameters, it is necessary to proceed carefully, since no reliable and generally accepted data concerning errors of measurement and fabrication are available. Existing optical industrial measuring tools are adapted to measure only relatively small work. Up to 200 mm. the true dimension may be determined rapidly and with great exactness. The determination of dimensions on large work is quite a different proposition. In the inspection room, such large work raises serious difficulties, and that is why its true dimensions remain mostly indeterminate.

Moreover, it should not be forgotten that, during the production of large work, micrometers are generally used and that production is on a single piece basis. Because of this, the difference between the measured and the specified dimension may be considerable. This discrepancy is caused not only by differences in temperature between the measuring tool and the work, by elastic distortions and by subjective errors in measuring, but also on account of the difficulty of adjusting the measuring tool to the desired dimension. Unavoidable errors of production, impossible of detection under average shop conditions (for instance, errors caused by temperature), and inexactness of the measuring operation in itself, should, if possible, be provided for by a smaller working tolerance.

On the other hand, the workman should not be forced to work to close limits too difficult to realize with shop measuring tools. Yet the requirements of accuracy for large work are often great, partly because of the fear of expensive scrap or of misunderstanding in case the pieces to be assembled are machined in different shops. High accuracy requirements entail small tolerances, and these are difficult to realize and to measure.

Two Sets of Gages

To satisfy as far as possible the above-mentioned requirements, it is reasonable to establish for large work two kinds of tolerances, namely, greater ones for customers' inspection gages and smaller ones for shop gages.

The customary way of establishing customers' inspection gages is to attach them to shop gages (figuratively speaking) and to follow them closely. For large work, it is more reasonable to make the difference between the tolerance fields considerable so as to absorb all casual and unavoidable errors of fabrication. The work is protected thereby against scrapping when inspected by the customer.

How is it possible to determine the maximum tolerance of large work for different grades of workmanship? There is only one way—by experiment. For each grade of workmanship, fine, medium and coarse, the permissible deviations are determined. These always depend on the accuracy of measuring tools, on out-of-roundness, on the influence of temperature, elasticity and subjective errors. The sum total of all these errors, or a certain part of the total, may be then considered as maximum tolerance of large work (500–3,000 mm. or 19.68–118.11 in.).

Such an experiment, to determine the maximum tolerances of large work up to 3,000 mm. was carried out by the author of these notes. The work tolerances were expressed in percentages of the customers' inspection tolerances (65–80 per cent). However, it is also possible to take the work tolerances as a starting point, provided that these figures do not provoke any objections of an economic character (wages, scrap, etc.). The maximum tolerances of customers' inspection gages are then obtained as a multiple of the working tolerances, a real insurance against unavoidable errors of fabrication that cannot be detected by work gages.

Between the diameters 1–80 mm. for which the international proposals are already worked out and the diameters 500–3,000 mm. to which the figures to be enumerated later mostly refer, is located the range 180–500 mm. which, with regard to reliability of inspection by means of limit gages, maintains an intermediary position. In this range, the work of the subcommittee ISA_3 is not yet finished. While deliberating over the first tentative proposal, the subcommittee started from the idea that it is only necessary to establish rules as to how to determine the figures referring to work limit gages. Yet the opinion prevails that an international standardization should first of all establish figures for customers' working gages, thereby insuring interchangeability and

avoiding misunderstandings and disagreements. Therefore, for the sake of security, the work tolerances (represented by work limit gages) have been reduced to a minimum, which is not expected to provoke any reasonable objections on the part of the user.

Following are some practical data on errors of fabrication and measurement obtained from large work, the workmanship corresponding to ISA Class 8. Naturally all these figures are approximate.

The following circumstances have a bearing on the results: selection of test pieces, local conditions, and especially the subjective interpretation of results. On one side are results of measurements performed by shop inspectors with shop implements and average shop conditions and on the other are figures obtained by an experienced and skilled personnel under favorable conditions with the same implements carefully checked.

1. *Inaccuracy of graduation* to which the measuring tool is set. In the fabrication of large work, micrometric instruments, fixed and adjustable inside gages, snap gages, or beam compasses are used which are set to the desired dimension by means of gage blocks (up to 300 mm.), or by means of graduated scales. Errors of graduation are first transferred to the measuring instrument and then to the work. These errors are approximately as follows:

Dia. mm	200	300	500	1,000	2,000	3,000
Errors in μ ±	12	13	15	20	30	30

2. *Inaccuracy of setting* the measuring instrument to the graduation. On a $\frac{1}{50}$-mm. vernier, the direct errors of graduation are $\pm 20\,\mu$. These errors are about the same for greater lengths, for instance, 3–5 m.

So-called contact errors according to investigations are:

Dia. mm	200	300	500	1,000–1,500	2,500–3,000
Errors in μ ±	15	15	20	20	20

Total errors of setting to graduation are then:

Dia. mm	200	300	500	1,000–1,500	2,500–3,000
Errors in μ ±	35	35	40	40	40

3. *Errors due to temperature.* When there is a difference of 3 deg. C. between the measuring tool and the workpiece, the coefficient of thermal expansion being assumed at 11.5×10^{-6}, these errors will assume the following figures:

Dia. mm	200	300	500	1,000	2,000	3,000
Errors in μ ±	7	10	17	35	70	100

4. *Geometric deviations* (out-of-roundness, taper, etc.). To determine these errors, large shafts and bores were produced by grinding or turning and inspected. The workmanship corresponded to ISA Class 8. The figures obtained are:

Dia. mm	200	580	870	1,000	1,500	2,000	2,500	3,000	3,500
Deviations in μ ±	30	50	55	75	80	60	120*	150*	300*
						95*		120	200

* Turned.

Besides the errors and deviations enumerated, there has to be taken account of elastic deformations of the measuring tools, subjective errors of the workman, and the influence of the smoothness (or lack of it) of the surface.

Elastic deformations of end-measuring rods are relatively small. Their sag caused by their own weight is noticeable only at great lengths; for instance at 3,000 mm. the shortening caused by sag is less than 40 μ. The distortion of micrometric snap gages is greater, but its disturbing influence may be removed or reduced by setting them to end measuring rods (fixed or adjustable), provided that their position and support are the same when setting and when measuring.

The subjective errors as a result of a large series of comparative experiments on the same work by different inspectors gave the following figures:

Dia. mm	200	400	1,000	2,000	3,000
Errors in μ ±	5	8	15	20	20

The influence of the surface quality may be removed or minimized by a reasonable selection of machining operations.

It should be emphasized that the measurement of large bores may be carried out easier than the measurement of large shafts. Under ordinary working conditions, however, the machining of large bores to exact dimensions offers great difficulties. On this account, it is not advisable to make a difference between bore tolerances and shaft tolerances (over 300 mm.) since these members fit together.

The sum total of all errors and deviations of large work and medium quality of workmanship, Class 8, enumerated under 1 to 4 above, furnishes the following round figures:

Dia. mm	200	300	400	500	1,000	2,000	3,000
Errors in μ ±	85	100	115	125	175	240	300

Although it is not probable that the maximum values of these errors will occur simultaneously, it is necessary to take care of others not specified here, resulting from elasticity, quality of surface, or workmanship. It should be noted that the fundamental tolerances for Class 8 of the tentative ISA standard above 200 mm. are 20–25 per cent below the figures enumerated above. The errors may be positive or negative, so precautions against scrap must be maintained on the "not go" side as well as the "go" side. For that reason, the tolerance field of proposed customers' inspection gages for diameters 180–500 mm. Class 8 is approximately 40–50 per cent larger than that of the work gages.

Summing up these conclusions:

1. Since the true dimensions of workpieces are not known to us, and since their exact measurement with existing shop measuring tools is possible up to 200 mm., the decision of the subcommission ISA to standardize the work tolerances (represented by work gages), is considered as correct.

2. The use of fixed and adjustable limit gages has shown that the true dimensions of work fabricated to them may be occasionally outside the limits of the "go" and "not go" side of the gage.

3. These sporadic deviations of the work from the dimensions represented by the gages are more frequent when the dimensions are large.

4. For smaller work (up to 180 mm.), fabricated to fixed limit gages of the customary shape, these deviations are not dangerous. For international trade, it is sufficient to establish work gages in accordance with accepted ISA standards. The establishment of standards for customers' inspection gages is not necessary. In the resolution of the Copenhagen conference, it is expressly specified that every piece is to be considered as acceptable if it passes gages having the extreme dimensions of work gages (including their wear).

5. For larger work (500–3,000 mm.) it is reasonable to establish two kinds of international tolerance: a smaller one for work gages with relatively narrow fabricating limits, and a larger one for customers' inspection gages, spanning the first. Between the border lines of

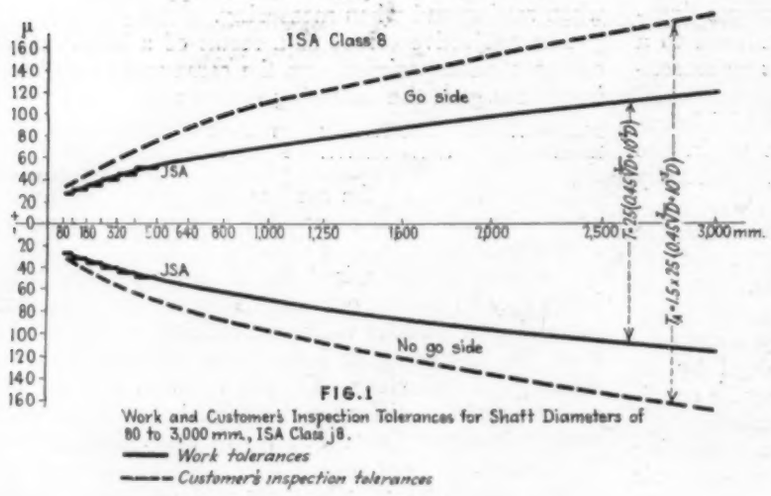

FIG. 1

Work and Customer's Inspection Tolerances for Shaft Diameters of 80 to 3,000 mm., ISA Class j8.

—— *Work tolerances*

– – – *Customer's inspection tolerances*

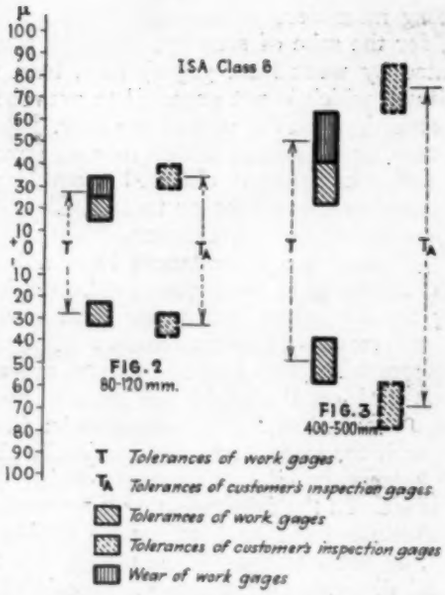

FIG. 2
80-120 mm.

FIG. 3
400-500 mm.

T *Tolerances of work gages*

T_A *Tolerances of customer's inspection gages*

Tolerances of work gages

Tolerances of customer's inspection gages

Wear of work gages

these two tolerance fields are equal or unequal strips, the object of which is to absorb all errors of fabricating that cannot be detected by work gages.

6. For work of the intermediary range, 180–500 mm., tolerances both for work gages and customers' inspection gages must be provided to prevent disagreements.

7. In order not to disturb the continuity of development of the international system from 1–3,000 mm., it is reasonable to establish two theoretical limits of tolerances, namely: one for work gages with fundamental tolerances $\theta\mu$, which increase with the diameter according to the formula $\theta = A\sqrt[3]{D} + bD$, proposed by the subcommittee ISA_3, and the second for customers' inspection gages with tolerances spanning the work tolerances. For smaller diameters, 180–1 mm., the theoretical limits of both gages draw closer together. From 180 mm. up, they separate gradually, the difference between these two gages amounting to 25–55 per cent of the working tolerance, according to grade of workmanship.

Fig. 1 shows the proposed arrangement of work and customers' inspection gage tolerances (fixed and micrometric snap gages) for ISA Class 8, and diameters of 80 to 3,000 mm. The full lines refer to work gages (up to 500 mm. graded in conformity with the proposal of the ISA subcommittee), and the broken lines refer to customers' inspection gages. The extreme resulting gage dimensions of work gages coincide approximately with the dotted line representing the customers' inspection tolerances. A perceptible difference is noticeable only after 500 mm. diameter.

Tolerances T of the Class 8 work gages are figured according to the following formula of subcommittee ISA_3:

$$T = 25\,(0.45\sqrt[3]{D} + 10^{-3}\,D)$$

Tolerance T_A of customers' inspection gages from 180 mm. ISA Class 8 up are figured according to the formula:

$$T_A = 1.5 \times 25\,(0.45\sqrt[3]{D} + 10^{-3}D).$$

The difference $T_A - T$ of the work and customers' inspection gages is not divided equally. The smaller part corresponds to the "not-go" side, and larger part to the "go" side, the ratio being approximately 5:7.

Figs. 2 and 3 show in full lines the mode of establishing fixed work gages j_8 according to the proposal of subcommittee ISA_3 for the ranges 80–120 and 400–500 mm. Broken lines indicate the construction of customers' inspection gages for these two ranges according to Fig. 1. As it is evident from Fig. 2, the dimensions of the customers' inspection gages for 100 mm. are identical with those built up according to DIN rules (German Engineering Standards). However, for the diameter 500, Fig. 3, the tolerances of customers' inspection gages are broader.

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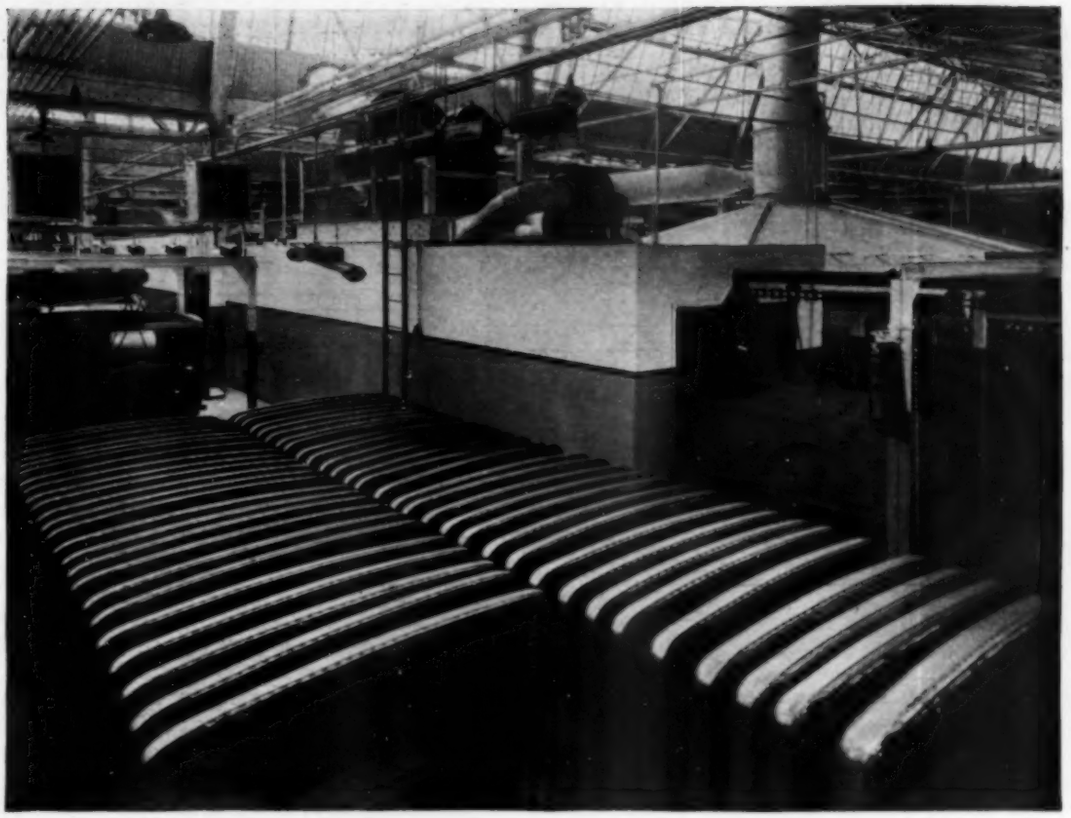
Sweating Pipes

HERBERT CHASE

THAT ANNOYING and corrosive drip resulting from the sweating of cold pipes or other surfaces in shops where there is steam or a damp atmosphere can be stopped by properly insulating the pipes. An easy and satisfactory way of doing this is followed in the Navy. It consists in painting the pipe with a suitable oil or paint with which granulated cork has been mixed.

Perhaps the best mixture for this purpose is one made from 30 per cent of boiled linseed oil and 70 per cent of fish oil to which is added a good turpentine drier in the proportion of one pint per gallon. The granulated cork can be put into this mixture in as large quantities as desired to apply readily, but is still better applied in dry form after the oil is on but is still wet. The more cork held in place, the better the insulation. Since the surface left is somewhat rough it helps to keep drops from forming in case the insulation does not entirely prevent condensation. The fish oil does not become hard for a long time and so does not result in the peeling or chipping which a harder drying vehicle may bring about. If the cork is applied dry and does not give the desired color, it can be sized and then painted.

Before any pipe or other metal surface is painted with the mixture recommended, it should be cleaned and primed. On black steel pipe, any good rust-inhibitive primer can be used. For galvanized pipe the best primer is a good linseed oil of low acid number in which pigment consisting of 80 per cent zinc dust and 20 per cent zinc oxide is mixed. Its use tends to prevent peeling which is prone to occur on any galvanized surface.



A battery of gas-fired boilers generates the steam used for heating the body drying oven. Bodies enter and leave it three different times at different points

Finishing Ford Bodies

Material handling plays an important part in painting and enamelling operations

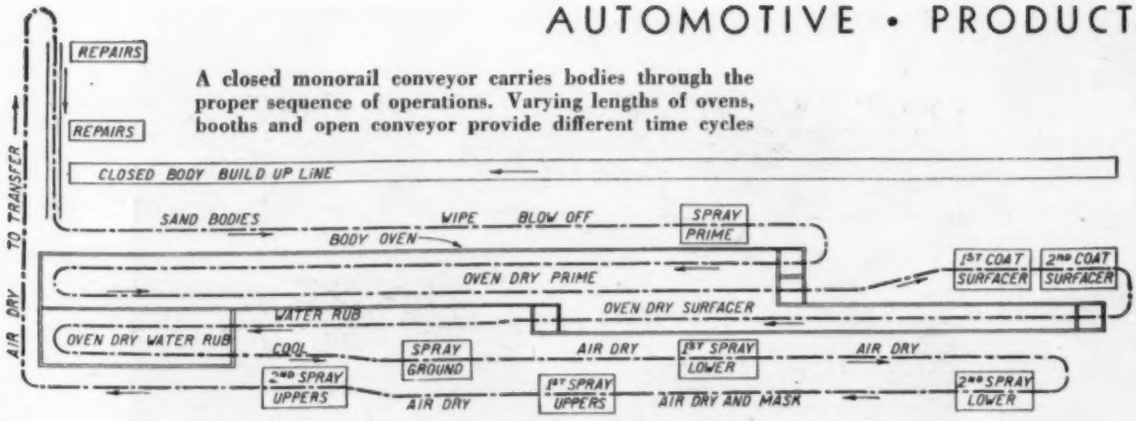
J. B. NEALEY
American Gas Association

PROFITING by the accumulated experience in its other plants, the Ford Motor Company recently installed what many consider an ideal finishing layout in its Long Beach, Calif., assembly plant. Particular attention has been given material handling, each process being completely conveyorized. The largest unit is a 1,870-ft. monorail for body finishing that winds back and forth on itself six times, through spray booths and drying ovens.

The principal oven is 437 ft. long and the first section is just wide enough for the conveyor to travel its length and return (two passes). The second section for drying surfacer is made wider to accommodate another pass of the conveyor and extends somewhat beyond. At the other end of this oven and built against it so that the conveyor passes into it without changing direction, is another 87½ ft. in length. Scattered along this conveyor are eight spray booths for eight different coats. Those coats not dried in these two ovens are air dried.

The body conveyor is of the overhead chain and hook type, motor driven at a rate of 39 in. per min. The first length of this conveyor is outside and parallel to the large oven. On it bodies are sanded, washed, wiped, blown off, tack ragged and the prime coat sprayed on in a booth. The conveyor then turns on itself and passes through the oven and returns for drying, the time being 150 min. and the temperature 225 deg. F. Passing through two booths in succession, the bodies receive the first-coat and second-coat surfacers, which are dried on as the conveyor passes through the enlarged section of the oven. This requires 30 min. at 250 deg. F. The length of conveyor exposed between the discharge end of this wider section of the oven and the entering end of the 87½-ft. drying oven is used to give the work a water rub. Drying is accomplished at 175 deg. F. in 27 min.

The conveyor makes a complete turn at the end of this small oven and returns parallel to the long oven. Here the bodies are cooled and pass through two spray booths in which they receive the ground coat and the first lower spray. In the sixth pass, the bodies go through three booths, receiving progressively the second spray lower, first spray upper and second spray upper, these coats being air dried on the exposed portions of the conveyor between. Booths are of glass, open at both ends for the passage of the conveyor and work, and hooded with fans to draw out fumes. This layout permits painting and drying 145 bodies every eight



A closed monorail conveyor carries bodies through the proper sequence of operations. Varying lengths of ovens, booths and open conveyor provide different time cycles

hours. The body oven, as well as other paint-drying ovens in this division, is heated with steam coils from gas-fired steam boilers.

The fender enamel and oils are delivered at room temperature from the storage vats to their respective places of utilization in the plant. Body lacquers are mixed in steam-driven mixing tanks, from which they are pumped to spray booths.

36,000 Feet of Pipe

It requires more than 36,000 ft. of pipe to make these deliveries. Fender enamel and oils of the larger consumption items, are stored in six steel tanks with a combined capacity of 148,000 gal., inclosed in a concrete pit partly below water level.

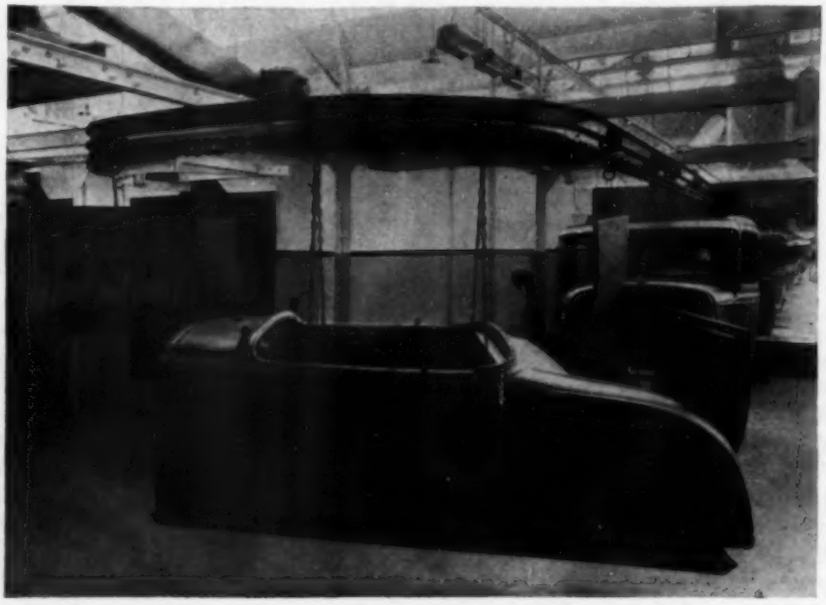
At the end of the sixth pass, the conveyor turns and runs at right angles to its former direction for 167 ft., and returns to the point of beginning. This added space is used to transfer the bodies to a series of slat-type conveyors where they are trimmed, sprayed with solvent, dried off, and polished. When finished they are stored on fourteen slat type conveyors, each 110 ft. long, of which half are located on a platform over the others. These conveyors operate at a speed of 75 in. per min., and will hold eleven bodies each, or a total of 154. They are held here until discharged onto the final assembly line.

The solvent is dried off in a 62-ft. oven, heated with steam coils at a temperature of 125 deg. F. The drying period is 14 min.

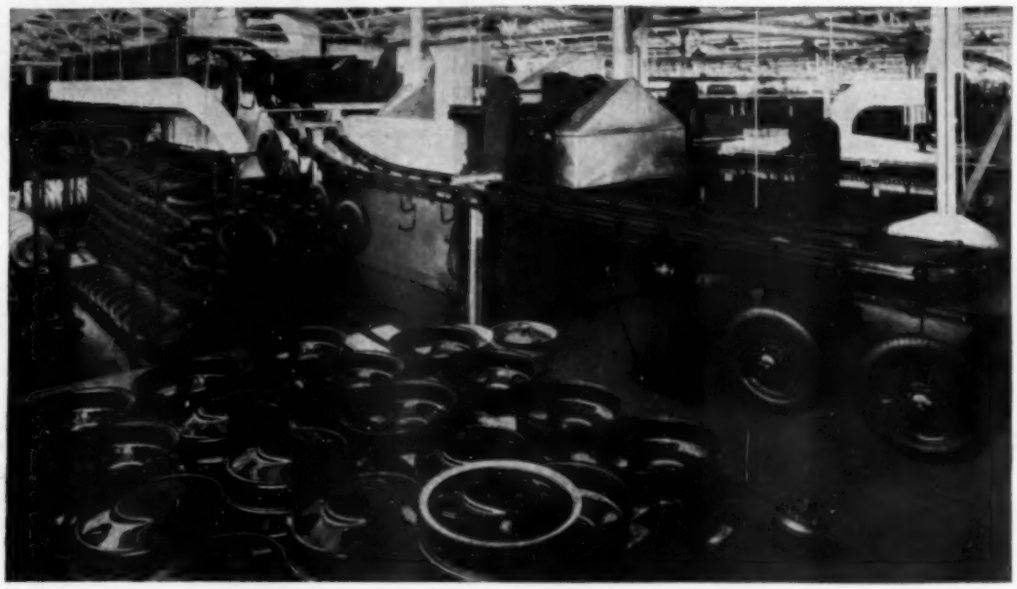
When two or more ovens are located over the same conveyor, which operates at one speed, the different time periods necessary for drying various coats of paint are regulated by lengths of the ovens. This provision constituted one of the most important factors in the original design, which also took into consideration the necessary lengths of exposed conveyor between spray booths where the air-dried coats were applied. On the single body painting conveyor there are twenty-three different operations, to each of which a different time period had to be allowed for when designing the layout. The result constitutes one of the most intricate layouts for this type of work, yet this unit operates as a whole, smoothly and efficiently.

The closed-body build-up line is parallel to the body painting unit and consists of a motor-driven slat type conveyor 225 ft. long and operating at 27 in. per min. Bodies are spaced on 12-ft. centers, and it requires 100 min. to build one up. They are transferred from the end of this conveyor to the body painting conveyor.

The 60-ft. sheet-steel wheel oven is heated with hot air blown into it from separate heaters located on top and at one end. This oven completely incloses a motor-driven conveyor operating at a speed of 8 in. per min. One end of the oven is open, and the wheels are loaded on and removed from the conveyor at this point. Close by are two mechanical units for black enameling wheels. Here wheels, one at a time, are automatically lowered for immersion, raised and rapidly rotated to throw off surplus enamel. Operators then transfer them to the oven conveyor. It requires 1 hr. 20 min. for them to make the round trip in the oven which is carried at 375 deg. F. A 660-ft. overhead traveling chain conveyor adjacent to the oven is used for cooling. Finally



Winding back and forth upon itself six times, the body conveyor, in one of its passes, doubles through this 437-ft. oven to dry the priming coat



Wheels are dip-enamelled singly, then whirled in the same machine to remove excess enamel. The whirlers may be seen below the conveyor, which takes the enamelled wheels into the oven for drying, then doubles back upon itself to bring them out at the same end for cooling and mounting of the tires

the tires are mounted on rims and conveyed to the assembly line. Wheels to be colored are sprayed and sent through one of the other ovens.

The heater on top of the oven consists of a sheet steel, casing inclosing a combustion chamber lined with refractory tile and containing banks of heating elements. Each heating element is composed of a large number of interlocked specially shaped pressed-steel tubes. The six gas burners are of the atmospheric tile type operating on pressures of 12 to 15 in. water gage. They fire directly into the combustion chamber, the hot products of combustion rising up and around the tubes under negative pressure caused by the pull of the fan in the stack. Cold air to be heated passes horizontally through the heater tubes under positive pressure furnished by the supply fan.

Ventilation and Circulation

Enough draft is supplied by the fan driving the fresh air into the heater to force it past the tubes, where it is heated, and on into the oven through ducts. An induced draft fan, located on top and at the opposite end of the oven, draws the hot air through the oven and vents it to the atmosphere through stacks. A hood partially covers the end of the oven where the operators load and unload, and another induced draft fan pulls up and vents what heat might otherwise escape through the opening.

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Injection Molding as Practiced in Europe—*Discussion*

IN THE article by Herbert Chase under the above title (*AM*—Vol. 76, p. 233), one point should be expanded regarding the hydraulic injection machine of Francis Shaw & Co. Ltd., Manchester, England. The article states that pressures up to 1,000 lb. are used on the hydraulic machine, but the company usually recommends 2,240 lb. per sq.in. for operating.

A Bit of Mechanical History

C. M. CONRADSON
Consulting Engineer, Green Bay, Wis.

IN THE "Obituaries" (*AM*—Vol. 76, page 192m) two erroneous statements were made. Mr. Gallinger did not invent the differential gearing now used universally in automobiles. The "jack-in-the-box" was first applied to a self-propelled vehicle by Dr. Harland of Middlesborough, England, at the beginning of the last century. He applied it to a steam-driven carriage. This also disposes of the claim made that Sir Alfred Yarrow built the first steam carriage in England. If necessary, the fact that Sir Richard Gurney built a successful steam carriage in 1836 could be cited. Dr. Harland was the co-founder of the shipyard of Harland & Wolff of Belfast, Ireland, builders of the White Star fleet.

It is true that Mr. Gallinger built a steam-operated road wagon in 1877, but it was not successful and nothing came of it. In 1877 the Wisconsin legislature offered a prize of $10,000 for a steam wagon to be built that would best fulfill certain conditions laid down. Mr. Gallinger entered his machine in the competition, but the prize was not awarded as none of the various entries met the conditions. They were extremely crude and clumsy and in addition the roads were in frightful condition. One machine stuck in deep sand on the old military road thirteen miles south of Madison.

James Baker of Madison, whom I knew, entered a wagon also embodying the "jack-in-the-box." There was at that time nothing novel in this device. It had been used in textile machinery and in wire mills for the best part of a century. It was shown in one of the earliest editions of "Der Konstructeur" by Reauleaux. I read my copy in 1879.

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(The Gallinger obituary read "a differential"—not "the differential," which would imply that one now used. The Yarrow obituary read, "claimed to have." Mr. Conradson's discussion is, however, of unusual interest and thus warrants publication—Ed.)

The FOREMAN'S ROUND TABLE

Too Much Imagination

"MORNING, AL, where were you yesterday?"

"Why? Were you looking for me?"

"Not for anything particular; I called up to ask if you wanted to go fishing, and May told me you were out walking somewhere. Why not call a feller up?"

"I would have, Ed, under ordinary circumstances, but a friend of mine, one of the superintendents of a big plant upstate, dropped in to tell me his troubles."

"Who was he? Any one I know?"

"No, I don't think so. His name is Mason. I don't think you know him."

"No, I don't. And if he's got troubles, I don't want to, either."

"Well, I thought it was going to spoil my Sunday, too, but while we were out we met Watson, the industrial engineer, and altogether I had a pretty nice day."

"Did you settle your friend's troubles?"

"No, I don't know's I did that, but he went home feeling better."

"What was his trouble, anything private?"

"No, not at all. He simply isn't happy in his job and is talking about quitting."

"Quitting? Now? What's he got, a rich father-in-law or temporary insanity?"

"Neither. He's a nice feller and as keen as they come, but he knows he's not making good, and feels that he might as well quit before he gets fired."

"What good'll that do him? Does he want a job with happiness guaranteed? Find one."

"Well, he's partly right, Ed; he's in the wrong place. A man can't be efficient unless he's happy in his job. I was glad we met Watson, because he gave Mason the common sense view of the thing."

"Yeah, and what might that be?"

"Watson told Mason he was suffering from mental depression, or fatigue, because there was not enough variety to his work. He said that a man of great mental and physical energy should never accept a strictly repetitive job unless it was big enough to send him home tired every night. He said the trouble with energetic men is that they can't loaf gracefully."

"He's right, Al, I can't. That's the reason I like to fish. But other times I want to know that I am alive, especially when I'm at work."

"I guess we're in agreement there. I was offered a job as assistant superintendent in a big shop not long ago, and when I talked to Williams about it, he told me I'd be sick of it in a month. At the time I thought maybe he was prompted by self-interest, but Mason's case makes me think he was right."

"I guess he was at that. But how about the poor guys that work in that kind of a plant? It's bad enough to leave the house at the same time, follow the same old route and meet the same old faces on the way. Then you go in the gate, say 'good morning' to the same old watchman and go into the shop to face the same old machines. Honestly, Al, I sometimes get sick to my stomach when I wake up in the morning, and realize that there is no end to it. Think of the man running a machine in some of those mass production plants. Day after day, year after year, if he can stand it, he plugs along on the same old machine, making parts the use or purpose of which he knows nothing about. Is it any wonder he quits? If a foreman or superintendent can't be efficient unless he's interested in his job, isn't it about time they found some way to inject interest into the ordinary man's job? Maybe they have energy and imagination too."

Does it take one type of man to work in a shop where the work is always the same, and another where it is always different? Is this difference, if any, a matter of skill, or temperament? Is the workman subject to the same differences and can his job be made more interesting?

Discussions

Functionalizing

The production head's dream of a blissful state wherein parts and operations move sweetly on schedule can only become partly true, failing to attain perfection through various irritating causes in which the human element must always play a conspicuous part. Yet the central idea, whereby each man becomes strictly responsible for a certain unit of production, is a goal to be aimed at.

To attain this end it is obvious that each man's duties must be clearly defined and no defections tolerated. To illustrate: A certain number of bushings are required for a small bearing. The screw machine operator machines ten per cent of the quantity 0.001 in. under the diameter required for a press fit and is ordered to knurl them to the required diameter. They are passed for assembly and pressed into the ball bearing with the result that the final assembly is rejected because of running out.

With proper functionalization, the bushings would have been rejected at the source, with saving of time, money and temper—which inclines me to the belief that effective functionalizing, by segregating responsibility for the successful performance of each operation, strikes directly at the basic hindrance to productive efficiency. —ROBERT S. ALEXANDER.

Overloaded

The principle of paying machine operators for loading only is both sound and fair. Men working on production are, to a large extent, human feeding mechanisms; their work is primarily loading. The number of machines per operator depends on the length of each cycle and how well machines can be grouped.

When time allowances are set, it would not be fair to time only the loading time if the man is not kept fully occupied. The ideal condition is to have a machine tripping off just as the previous starting lever is thrown over. The ambitious man prefers to be slightly behind his machines rather than to wait for them.

It seems to me that it would be a strange shop where the help could run any machine selected and form groups to suit themselves. The group working idea is suitable on many jobs, but management must direct and have control. Human nature has not yet reached a point where a collective arrangement is fair to all when little or no bossing is in evidence. —L. F. SWENSON.

Old Man Opportunity

Men envy others with good jobs but are not usually willing to equip themselves for such work. They would certainly not spend much spare time without pay. Future prospects of reward would not satisfy. Even now, men have ample opportunity of which they do not avail themselves. But even supposing they were, themselves, willing, trade-unions and fellow craftsmen would object, and obstruct them.

Nor would firms generally countenance the scheme. A few would take full, even undue advantage, thus getting work done for nothing.

—WM. BRYCE, *Sheffield, England.*

Carelessness

There are many points to be considered when judging the qualities of men. At the top is the accurate, speedy man who is a real asset to any employer. After him we have the accurate, but not so speedy employee, who also is a profit maker. Then comes the less accurate but speedy man who should be classified as a good man on less accurate jobs. Running down the scale we find the slow and less accurate workman who will cause his foremen much worry. It is evident that the same rule cannot be applied to all of these men.

The difference between carelessness and error of judgment cannot be defined by any set of rules. If an executive is earnest and serious about his job, none of his doings should be called an error of judgment.

I do not believe in three days layoff for the second offence nor for the third. A better rule would be to warn the offender three times. If he still makes mistakes he should be discharged.

—A. E. FRISTEDT, *Stockholm, Sweden*

Run-of-Mine

It is regrettable that most people commit the error of judging a man's abilities in terms of salary received. Because of lack of a liberal education and wide experience, the average person does not appreciate real, lasting values. He forgets or does not know that a motion picture actor receives higher pay than the President of the United States, that a baseball player in the major teams receives higher pay than the Chief Justice of the Supreme Court, that a successful plumber nets more money than a college professor. But really, who is the most successful? And so with Ed. He thinks that, because the shop worker gets smaller wages than other tradesmen, he is inferior. That is far from true. The usual shop worker is paid less because he does not spend four years of apprenticeship to learn a trade, which could be learned in four weeks, as is the case with the bricklayer, the electrician, etc. The employer is willing to show him a few things about his job that he may pay him less. I have observed and studied human nature and behavior quite intensively and have found that the average shop worker is even superior, intellectually, to many men of other occupations who get twice as much money. The office worker feels superior to the shop man because of the clean shirt he wears, which he does by virtue of the existence of the factory and the fact that management, for unknown reasons, grants the office worker greater privileges.

—GEORGE BELBES.

Other Times, Other Men

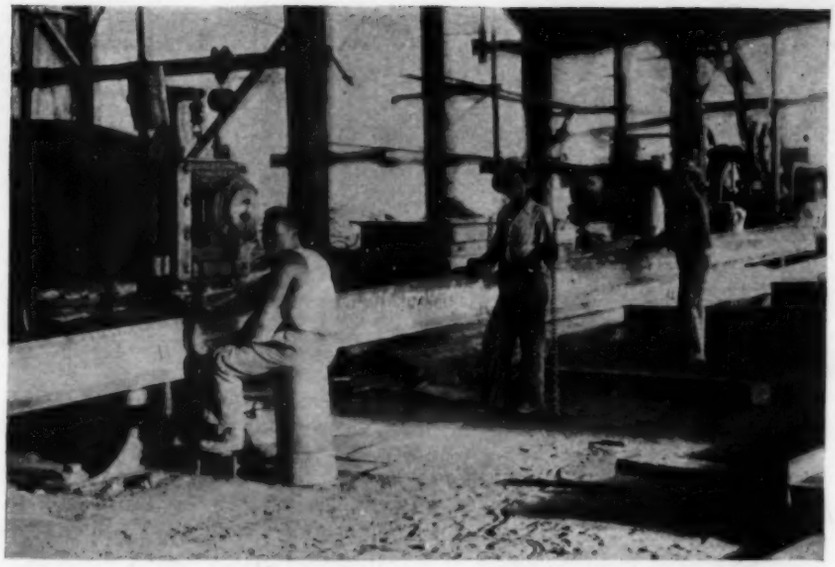
The fact that the heat-treating gang will not be rehired, proves that something has been wrong with the management. The management needs to be changed, not the gang.

The heat-treating gang no doubt has gotten into a rut because of the lack of proper management. The same thing will happen again if a new gang is put on with the same management in charge.

Often men are hired to do a certain class of work, put into the shop, and turned loose without proper supervision. They do the best they can. It is management's job to see that the standard of work is maintained, and the men instructed to do the work accordingly.

—CHARLES RINKER, *Engineer, International Harvester Company.*

Most Filipino metal-workers are bare-footed specialists of the "handyman" type who must be told what to do operation by operation. Equipment is poor and inadequate, patterns are poorer, but the work gets done eventually



Shops of the Philippines

WALTER BUCHLER
London, England

IN THE DAYS of Spanish rule in the Philippines, there were no machine shops of importance except a few marine repair shops. Industrially, not much progress had been made. Sugar centrals, modern cigar factories, cocoanut oil mills, rope factories, all have come into being since the American occupation in 1898.

It was not until 1906 that the boom in trade and industry started, thanks to free trade between the United States and the Islands. Gold mining expanded first. Later centrifugal sugar mills were opened. In 1912 the cocoanut oil industry introduced modern machinery. All these developments called for repair shops, and outside of the larger sugar centrals, which have more or less modern shops, factories in the Islands have no large repair shops attached to them. They may do their minor repair work, but they send the rest down to Manila where there are three large repair shops, the Atlantic Gulf & Pacific Co., Earnshaws Docks & Honolulu Iron Works and the Navy Dockyard. In addition to these, there are numerous Chinese and Filipino repair shops, but all operating on a small scale.

In the province of Batangas there is quite an industry in making bolos, which are long knives used by the natives for cutting sugar cane, working in the forests or in fact for cutting anything. These are made by small Filipino shops equipped with native-built forge, anvil and a few tools.

The majority of the hands employed in the shops of Manila, as well as in those of other cities in the Islands where there are shops, are Filipinos. Chinese establishments usually employ their own countrymen, as they work better together. The Filipino comes into a shop as a young man, anywhere from 16 years of age or older. He is not bound by any formal apprenticeship agreement but works as assistant to the journeymen in his particular shop, acquiring experience. He is paid a small wage right from the start, and it takes probably four to five years before he becomes a journeyman. A characteristic of the Filipino working in the shop is that he is sensitive to criticism, but he appreciates kind treatment ,and it shows in the spirit with which he goes about his work. The personal equation enters more in the work done here than in any other country in the Orient. A Filipino will work at a lower wage for a man he likes than for one he does not.

The majority of the men working in the machine shop, such as lathe, planer, milling machine, drill press and shaper hands, are specialists, working on only one machine. Some, however, are more adaptable and can turn their hands to almost any machine. Bench hands will

do any kind of bench work, such as scraping bearings and fitting keys. One drawback of the average Filipino is that he lacks initiative, probably because he is not mechanically minded. He learns without trouble, but it is after the manner of a parrot. The result is that, while he will work for little money, the white man who is over him has to be skilled all round; he has to know the details of everything and must be constantly on the job, watching personally every piece of work that goes through. If he does not do this, the job is likely to be spoiled. For example, give a Filipino lathe man a job and tell him the diameter. He turns this out satisfactorily but must then be told what next to do. Each operation has to be explained as it is begun. The same applies to all hands.

Time is immaterial to the Filipino, and the average man has no conception of speeding up a job. If a man is left to his own devices, he will invariably take a light cut although the machine and job will stand a heavy cut. This may or may not be done intentionally in order to make the job last as long as possible. Because of the great variety of work that goes through the shops here, practically all repair and breakdown jobs, most shops are not equipped with the best type of machine for some particular work. Often a piece will be done on a lathe that could be done much better on a boring mill, which in all probability the shop lacks. At times, the Filipino foreman will exercise considerable ingenuity in accomplishing a job on a machine that is not suitable for that particular work.

A peculiarity of the men working in the foundry is that they will squat on their haunches to do work which could be much more satisfactorily done on the bench. This slows up the work and lowers the quality of the work done. They, too, require that every move be explained to them in detail and the workmanship on the whole is poor. The foreign superintendent cannot stand watching them all the time. The patterns most used are those sent in by customers, and in the case of those coming from the provinces, are often rough patterns made by carpenters who know nothing of pattern making. This also tends to injure the quality of the work turned out. As far as core ovens and sand mixers are concerned, the equipment found in the foundries of Manila is poor. They either lack these items entirely, or where they do have them, they are not of the latest or best type. The ovens may have been made locally

under the supervision of a *capitaz*, or foreman. whose knowledge of designing is limited if he has any at all. Mixing of core sand is done by hand, and the quantity of each different material is mostly guesswork. Consequently cores are not uniform. Molders here bed in all jobs and use only a cope flask on jobs that a molder in the States would not attempt to bed in. The result is that it takes longer, and the casting is not satisfactory because of not being properly rammed at the bottom. When the iron is poured, the mold will expand and make the casting weigh more than it should.

Patterns, Molds and Castings

Filipino patternmakers are not skilled when compared with American or European patternmakers, because they have never had proper instruction in the art. What they do know they have picked up working as handymen. A contributory factor is that most of the work is of the repair class where only one casting is made, and customers in the Islands will not go to the expense of having good patterns.

Philippine mahogany and white pine from the United States, together with a local wood harder than pine but not a hardwood, are used for making patterns. Excessive moisture in the air makes the climate hard on patterns.

For molds, mostly local sand is used, but it is not a good sand as it contains too much alumina or clay. To overcome this, molds must be vented to a greater extent than would be necessary with more suitable sand. For steel molding, sand brought in from the United States is used with China clay added.

Brass, cupola and steel furnace tenders require constant watching or else the heat will go wrong. In case of steel, they are likely to get a "wild" heat while in brass furnaces, if not watched, they will get oxidized metal. This is caused by their not realizing that there is any difference in the quality of flame. To their minds any flame is satisfactory as long as it will melt metal.

Many men in the foundry prefer to work in their bare feet, as they have not been accustomed to shoes. After all, one cannot climb a cocoanut tree with shoes, and shops have only been established in the islands, on any modern scale, since the American occupation. An actual instance will enable the reader to see how inbred is this habit. A Filipino, who was squatting on his haunches on the floor, chipping a small casting that should have been chipped on the bench, was told to do the job on the bench at a vise. He started to do so, but on the foreman's return he was found squatting on the bench holding the casting with his toes and chipping it as he had been doing on the floor. The skin on a native's feet is very thick, and he will go where a white man could not without hurting himself. The disadvantage of working in bare feet lies in the likelihood of burns from spilled metal. When this happens, all hands will drop everything and scatter.

Unlike India, China and one or two other Eastern countries, the majority of Filipinos working in shops have been to school and can read and write English, but they do not yet seem to be able to grasp the meaning of things mechanical. In this direction, their education has not done them much good. Wages range from 1 to 4.25 pesos for skilled mechanics, and the hours worked are usually nine a day. Men are not hard to get; they travel from one shop to another, and even with the present depression in trade and industry, manage to find a berth somewhere.

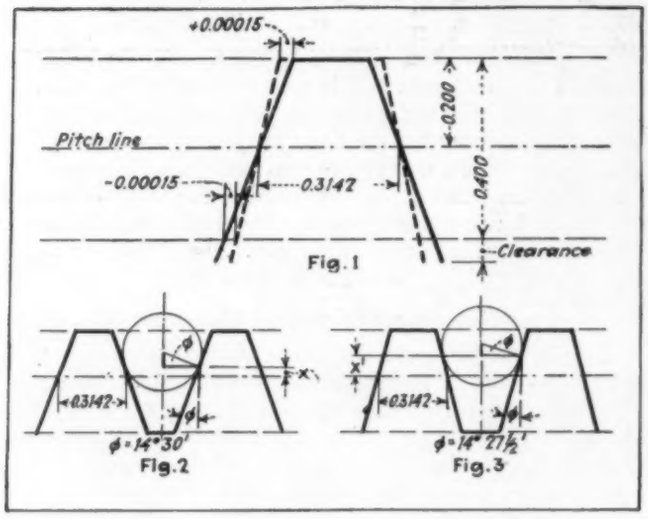


Fig. 1

Fig. 2

Fig. 3

Pin Measurements and Backlash

Factors other than lubrication influence the amount of backlash needed. Measurement across pins held between the teeth may be used as a check

SAM TRIMBATH
Gear Consultant

SINCE compiling the table for determining the measurement of spur gears across pins (*AM*—Vol. 73, page 793), I have received several inquiries regarding backlash, as the sizes given are for gears at standard center distance without backlash. There have also been some questions on the effect of tooth form errors on the measurement across pins inasmuch as the pins do not contact at the nominal pitch line.

To answer the first inquiry, it is necessary to consider the reason for backlash in gearing, as most installations require its presence to some degree, although in certain applications such as automobile timing gears very little can be allowed.

First there is the problem of lubrication. But aside from that, no necessity for backlash appears, until it is considered that perfection is not likely to be attained in tooth form, tooth spacing, concentricity and center distance. Should any eccentricity exist when attempting to operate gears meshed tightly, the teeth will tend to wedge themselves as the high sides come in contact because of errors in tooth form and spacing. Although these errors may be small, it is soon discovered that the problem of quieting gear operation is somewhat simplified by a reduction in tooth thickness. For this reason, the combined reduction in a pair of gears which is termed backlash, sometimes receives more attention than it deserves, as involute action is not disturbed by a reduction in tooth thickness when a generating process is used in machining. Unfortunately the introduction of play between the teeth will not entirely overcome the effect of all errors and in itself solve the problem of quiet gear operation.

The above considerations lead to the conclusion that the necessary reduction in tooth thickness is dependent upon the tolerances maintained in the other factors involved. As no simple rule can be given for the relation between a change in center distance and backlash, or eccentricity and backlash, it then follows that when the measurement across pins for gears of standard tooth thickness is known, the necessary reduction can be expressed just as readily in terms of a reduction in measurement across pins as in terms of backlash. For example consider the following limits:

$$\text{Center distance} = \begin{matrix} -0.001 \text{ in.} \\ +0.001 \text{ in.} \end{matrix}$$

Eccentricity (maximum) = 0.001, (this is usually taken to mean ½ the total runout).

Tooth shape limits (one side of teeth) = 0.0002 in.

Spacing limits (adjacent teeth) = 0.0002 in.

The clearance necessary must allow for wedging, center distance variation, eccentricity, spacing and shape differences or a total of 0.003 in., to which may be added 0.002 to permit lubrication of the tooth surfaces. The measurement across pins would then be reduced 0.005 in. on each gear of a pair. Where the gears are to be heat-treated after finishing, an additional reduction should be made if it is found that the gears increase in size.

Tooth form errors are held to small tolerances and have a relatively small effect upon the measurement across pins dependent on the distance from the pitch line to the point of contact. These errors quite frequently represent a difference in pressure angle, as explained in the description of my gear cutter comparator (*AM*—Vol. 75, page 296). The pins contact above the nominal pitch line in a majority of cases, the distance from the pitch line to the point of contact becoming greater as the number of teeth is increased. As the largest number of teeth would be represented by a rack, we can, by assuming a difference in the angle of rack, make a comparison between tooth form errors and distance from the pitch line to the point of contact.

Assuming Fig. 1 to be a 5-pitch, 14½-deg. pressure angle rack, and the dotted lines a difference of 2½ min. less, we have an error in tooth form of 0.0003 in., the teeth becoming thin towards the root and thick towards the top. In Figs. 2 and 3, pins 0.350 in. in diameter are shown contacting with rack teeth representing 14 deg. 30 min. and 14 deg. 27½ min. respectively. Computation for the distance from the pitch line to the points of contact X and X' gives 0.09145 compared to 0.09160 or a difference of 0.00015 in., the difference decreasing as the number of teeth is decreased.

Referring again to Fig. 1, it can be seen that unless the tooth form is held to small tolerances, the teeth may be too thick or thin at some point other than the pitch line, consequently the use of pins contacting at the pitch line would not prove advantageous.

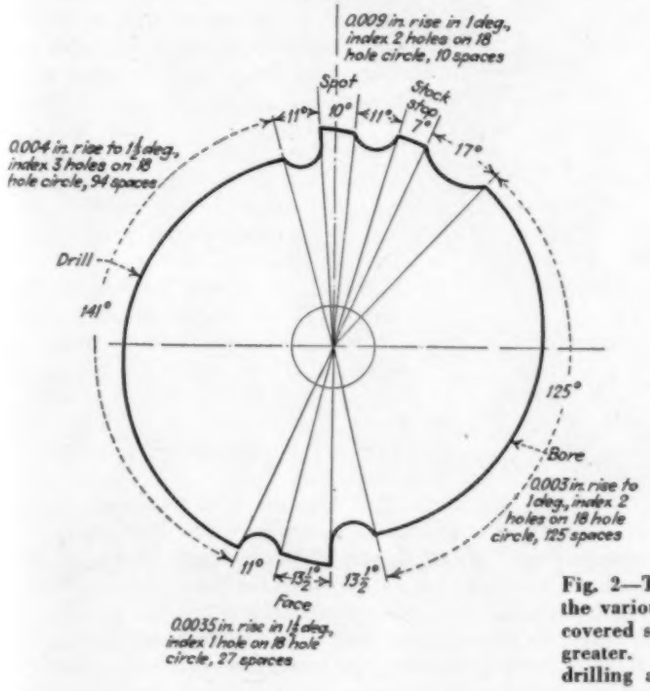
Cams for Automatic Screw Machines

W. C. BETZ
Master Mechanic, The Fafnir Bearing Company

IN LAYING OUT jobs for the B. & S. automatic, many plate cams must be made from time to time. To lay out a cam, it is necessary to determine how long each operation will require and to apportion the stations accordingly. Each phase of the turret cycle must be figured to insure economical production. In this way the cross slide gearing can be speeded up to cut down the time for a complete revolution of the turret cam to its most economical factor.

In Fig. 1 is illustrated the layout of a cam, showing the arcs required for each operation. The arcs are laid out in degrees or in any evenly divisible part thereof, so that the lobes can be milled without complicated indexing movements. The same cam laid out in linear measurements is shown in Fig. 2, giving a better idea of the functions of the various lobes and the rises in decimal parts of an inch.

Fig. 1—In laying out a turret cam, each phase of the cycle must be carefully timed to avoid unnecessary dwells


0.009 in. rise in 1 deg., index 2 holes on 18 hole circle, 10 spaces
Spot
Stock stop
11°
10°
11°
7°
17°
0.004 in. rise to 1½ deg., index 3 holes on 18 hole circle, 94 spaces
Drill
141°
125°
Bore
0.003 in. rise to 1 deg., index 2 holes on 18 hole circle, 125 spaces
11°
13½°
13½°
Face
0.0035 in. rise in 1½ deg., index 1 hole on 18 hole circle, 27 spaces

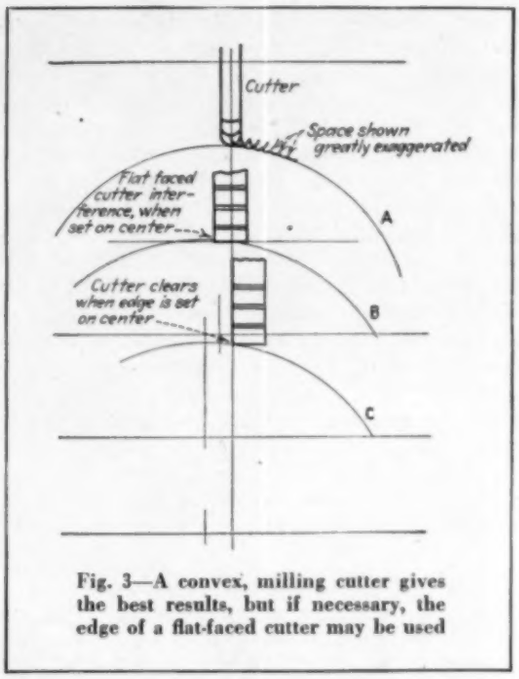
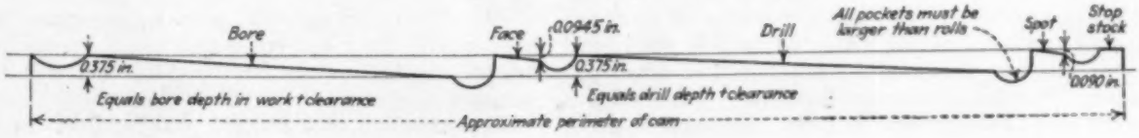


Fig. 3—A convex, milling cutter gives the best results, but if necessary, the edge of a flat-faced cutter may be used

After the cam has been laid out, all the roller pockets should be milled, with the cam held in the machine vise with the jaws at right angles to the spindle and using an end mill of the correct diameter. At this time, much of the excess stock can be removed from other parts of the cam. The cam is next mounted on a mandrel held between the centers of the machine, and the lobes are milled by starting at the high point of each, using a cutter having a convex face. The cuts are made across the face of the cam at a right angle, indexing between cuts a given amount in degrees or fractions thereof. The machine table is, of course, raised a given number of thousandths for each indexing until the lobe is completed. These cuts will leave the face of the cam with a lot of minute scallops, as shown at *A*, Fig. 3, which are filed out, the face of the lobe being afterward polished.

The reason for using a cutter having a convex face is that as the table is raised, each successive cut in the lobe is higher from the centers than the face of the cutter, and if a cutter having a flat face were used it would cut into the cut previously made and ruin the contour of the lobe. The effect of using a flat-face cutter is indicated at *B*, Fig. 3. However, a flat-face cutter could be used if its edge were set adjacent to the part just milled, as indicated at *C*, Fig. 3. While

Fig. 2—The developed view gives a better idea of the function of the various lobes. In the first cam made, the drill and boring lobes covered shorter arcs, the stock stop, spot, and face lobes being much greater. This meant slowing up the cam to get the proper feeds for drilling and boring, resulting in lost time on the lesser operations



this would eliminate interference, it would leave the face of the lobe with a series of fine ratchet teeth.

The lobes can also be milled by holding them on a mandrel in the dividing head, using an end mill, both the head and the mill being set at predetermined angles (see American Machinists' Handbook, pages 242 to 263, 4th edition). We have tried this method, but have found that we got along much better by using the method first suggested.

Plates for cams are best made of cold-rolled steel. The steel should be annealed before laying out the cams, so as to eliminate the strains caused by rolling. After finishing, the cams should be boiled in potassium cyanide at a temperature of 1,600 F. for twenty minutes and then quenched in a good, thin heat-absorbing oil. In quenching, the cams should be held edgewise to prevent distortion.

Since movements of the cross slide must synchronize with those of the turret, it follows that the cross slide cams must be made so that the work will be formed and cut off in the same time that the turret makes a complete turn. Cross-slide cams hardly ever need replacing, since they can be set in various positions on the camshaft in relation to the extreme rise of the forming or the cutting-off lobes, anchor-pin holes being provided for the purpose.

In laying out a turret cam, the layout should first be made full size on paper to determine the rises and degrees of travel of the various lobes for the operations to be performed. The rises for the major lobes, as for drilling, reaming, boring, and tapping, are determined by the depth the various tools must enter the work, adding a small amount to insure that the tools will not immediately ram into the work, but will make contact gradually. The layout of the lobes for the minor operations, such as stock stop, spotting or facing is made after all major operations have been settled upon. If a case arises where the major operations have been given too much room, they may have to be revamped so the minor operations can be worked in.

NEW BOOKS

THE INTERNAL COMBUSTION ENGINE—*By D. R. Pye, deputy director of scientific research, Air Ministry, England. 250 pages, 6x9 in. Indexed. 40 tables. Unit of Oxford Engineering Science Series. Published by Oxford University Press, 114 Fifth Ave., New York, N. Y. Price, $4.00.*

As a stepping stone to a knowledge of the basic principles of engine design and operation, (gas, gasoline and diesel) this book is considered ideal. Concise, but thorough, it leads the student directly through the subject so that he will be able to handle fuller treatises on thermodynamics. Design details appear only where they affect or illustrate principles. A valuable bibliography of books and papers by English authors is appended.

GRAPHIC STATICS—*By Seibert Fairman and Chester S. Cutshall, assistant professors of applied mechanics, Purdue University. 143 pages, 5¾x9 in. Indexed. 136 illustrations. Clothboard covers. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York City. Price $1.75.*

No book this for the mathematics lover, for it puts in graphic form many hitherto complex statics calculations. It is a development of the authors' 15 years' practice in teaching the subject, hence is planned particularly for mechanical engineering students with a thorough knowledge of statics. It will be found of value also to students of other branches of engineering and to the engineer and executive who prefers to graph stress and load calculations rather than to solve them mathematically. For the first time in a work of this sort, methods of determining static stresses in trusses and bents, cranes and machines are grouped in one volume. Also unusual is the liberal supply of illustrated examples, each solved in detail and explained. Problems, with answers, are provided for classroom use. Presentation is clear, and content good.

SUCCESSFUL LIVING IN THIS MACHINE AGE—*By Edward A. Filene. 274 pages, 5⅜x8½ in. Paper bound. Published by Simon and Schuster, Inc., 386 Fourth Ave., New York, N. Y. Price $3.00.*

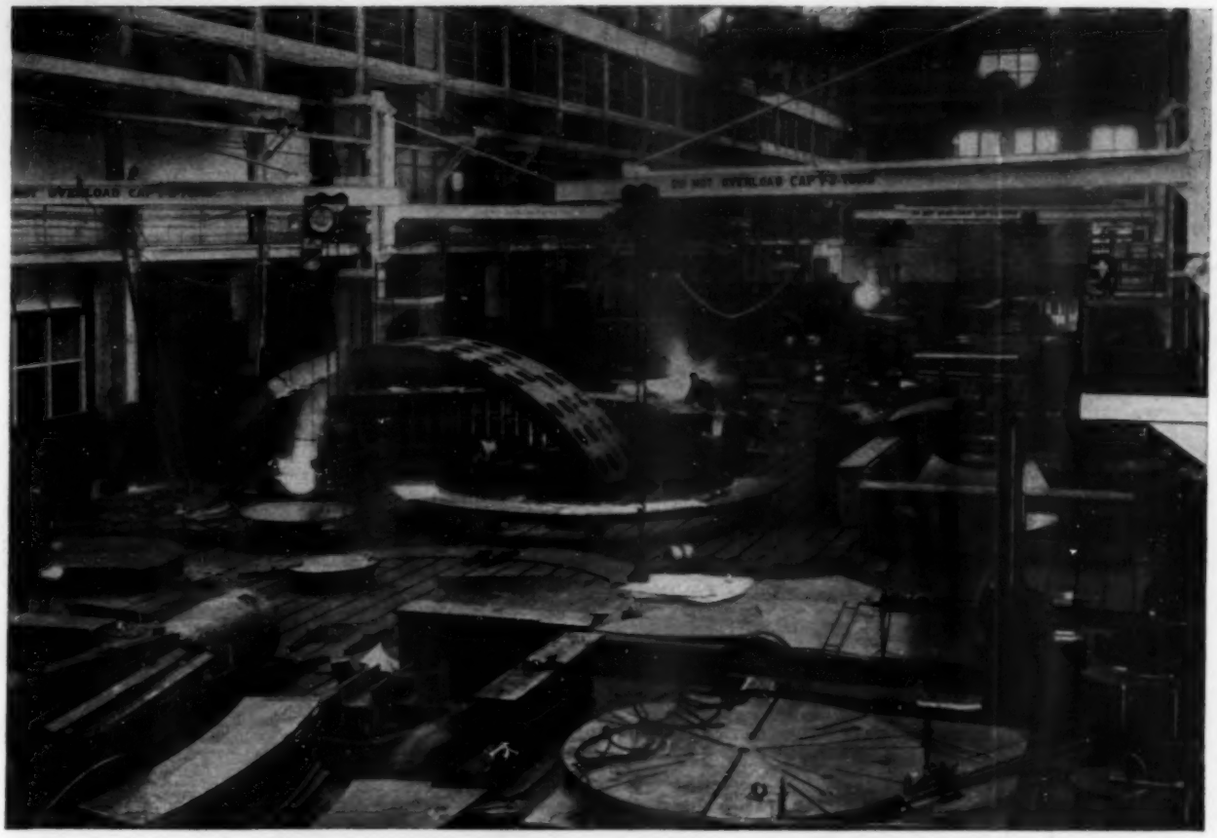
Perhaps "Philosophy of Mass Production" would have been a more definitive title. The author reduces our somewhat garbled thinking on present-day economics to its elements. His theme is to prove that modern methods of manufacture do not constitute an uncontrollable Frankenstein but may be shaped to meet our needs if we but understand and utilize the simple laws underlying them.

At the outset the term mass production is distinguished from merely large-scale production which does not recognize the need for an ever-widening market and low prices. "Mass production, therefore, is production for the masses."

Our gravest error has been to forget the consumer. We have regarded the market as an impersonal void into which the output of our factories could be poured. We have failed to recognize that this market is a collection of humans with needs and desires to be satisfied. And in building up the vast machinery of modern distribution, we have neglected to distribute purchasing power.

The author's method of treatment is to discuss mass production as it affects and is affected by various other business and social forces. In separate chapters, he outlines his views on mass production in relation to buying power, to credit, to unemployment, to the family, to politics, to communism, to the tariff, to world peace, to religion, to social planning, and to several other factors in our scheme of living.

Mr. Filene persistently seeks logical cause and effect which adds force and conviction to his viewpoint. Many of his conclusions are controversial and will find some readers dissenting. But the volume will contribute to clearer thinking on a subject vital to all of us.

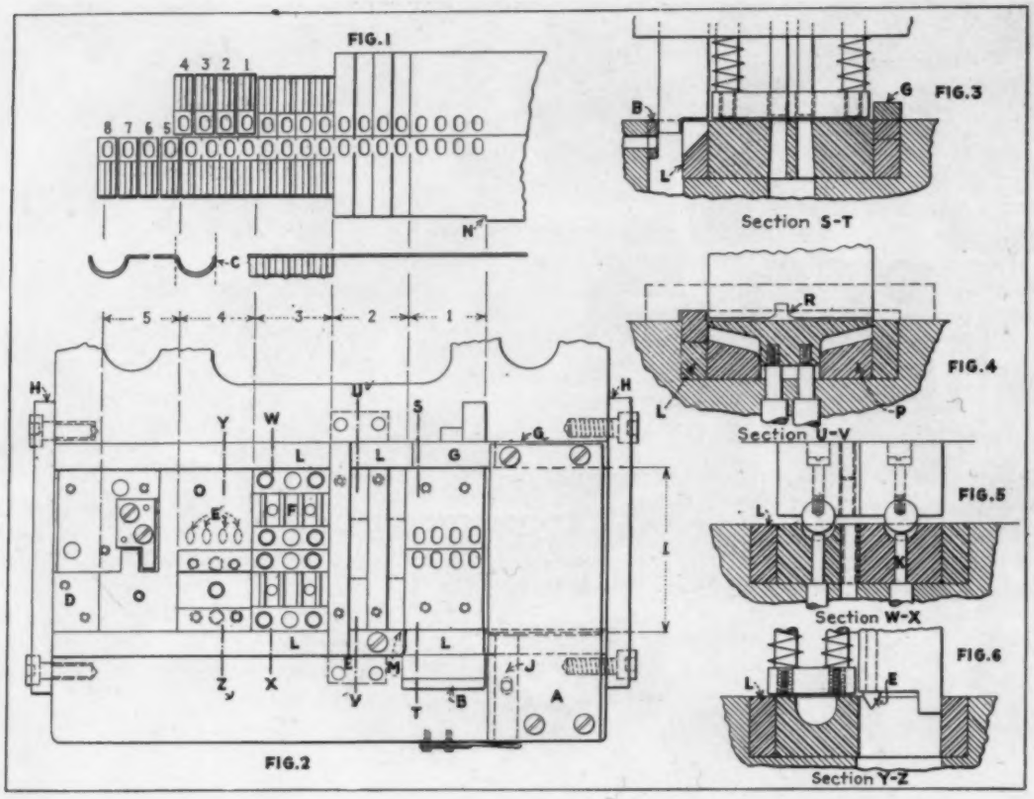


Two Large-Scale Welderies

Some idea of the layouts of today's large welding shops is given by these views of two Westinghouse plants

GANTRIES supplement overhead cranes for handling heavy work. The entire floor is one huge surface plate in the welding shop at East Pittsburgh. Cutting machines, straight and circular, are grouped and appear at the lower right; the weldery proper extends beyond.

Smaller surface plates, used at South Philadelphia, are raised above the floor level for convenience in working around them and screened to prevent harmful rays from affecting the eyes of workers in other parts of the shop. Many of the fixtures and frames are themselves of welded construction. Steel from which some sections have been cut is stacked by composition or thickness; cutting machines are grouped about a layout table.



Conduit Cleats—28,000 per Hour

Piercing, forming and parting are performed in one progressive die made by an American toolmaker while in Russia

WALTER WELLS

Tool Designer, Metropolitan Engineering Company

THE DIE described in this article might well serve as concrete proof of the saying, "the more haste, the less speed." If die design is such that pieces are completely severed from the strip before there is chance to form them, speed in production is retarded. For then, that operation has to be done separately and individually, instead of in groups on the strip. It amounts to a definite principle in die design to arrange the slitting and parting in stages, so that various operations of forming, drawing, bending or curling may be done at intermediate stations. This die embodies that principle and is capable of piercing, forming and severing eight complete pieces at each stroke.

Additional features of this die are: ease in regrinding both die and punch, despite the inclusion of a forming unit, the built-in construction, which solves the replacement problem, and the consideration given in the design to effect economies in making up the component parts.

In Fig. 1 is shown the strip. It is 0.020-in. soft brass $2\frac{7}{8}$ in. wide. It is successively trimmed, pierced, slitted, formed, halved and separated, to produce electrical conduit cleats. The punchings can be made with this die at the rate of 28,000 pieces per hour, allowing for the reloading at the completion of each roll of stock. After trimming and piercing at the first station, the strip is partially slit across. The forming is done at the third station, while at the following station, four finished cleats are completely severed from the strip and each other. At the last station, four more cleats are separated from the strip and from each other.

Referring to the die itself, Fig. 2, we notice that the strip *I* is fed in from the right and held positively against the gage bar *G* by the spring plunger *J*. The feed is continued until the corner of the stock abuts against the solid stop *M*. The punch, in descending, not only pierces the eight elongated holes, but trims the strip to the adjusted width for the subsequent forming operation. The shoulder or notch *N*, Fig. 1, that is left on the stock after the trimming is the means by which the automatic feeding action is controlled, the trim being the exact length of a station. The two slitting dies and punches cut the stock across from the front and back toward the center line as far as is necessary to permit the forming operation, thus leaving a bridge along the center of the strip about $\frac{1}{4}$ in. wide. Each die makes four cuts.

At the third station, a flattening operation is necessary at the sides of the ribs on the cleats. Without this precaution, the strip might become jammed in the die and thus prevent feeding. The dotted vertical line at *C* Fig. 1, marks the limits of the embossing for the ribs. The recesses on the forming die Fig. 5 therefore taper off at the sides to nothing.

For the halving cut, at the next station, the strip is guided to a central position by the pilot pins in the punch, their position being indicated on the die by the dotted lines at *E*, Fig. 2. The final slitting is performed by two small punches (not shown), one of which enters the gap formed between the die unit at Station 5 and the unit previous to it. An individual stripper acts on pieces that catch between the punches.

A Compact Die

The die is constructed compactly. The bolster pad is milled out laterally to receive a set of liner bars *L* which extend to the very ends and are confined by the hold-in plates *H-H*. The space between these liners is also milled out to a depth of one inch with the exception of the space at the extreme right. This milled out portion is squared up to a shoulder by a cross cut so that the first die may be seated in place. Next, two spacers alternate with a pair of slitting dies. The second slitting die is extra long, acting as a sort of key to integrate to liners with the die units. It also serves to take up some of the thrust. The firmly dowelled forming dies take up the remainder of the thrust. The liner bars are $\frac{7}{16}$ x 1 in. and are ground after hardening. Two of them are undercut as will be shown.

The halving die and the units to the right of it are all ground to the exact width allotted to a station, but the reslitting die has to be located by the trial and error method. This is because the cross-cut in the die has to match with the existing cut in the strip, and that a slight distortion may have taken place during the forming. After locating the die, it is pinned. The openings *O-O* go right through the bolster to permit finished pieces to fall through. A block is screwed at *D* to prevent pieces from piling up on the ledge. All units are fitted snugly into place between the liner bars. The auxiliary plate *A* helps to guide the stock and contains the slot for the spring plunger. The latter is actuated by a leaf spring.

When grinding the die, the plate *A* and the gage, which are held by two of the screws, are removed. The strippers at Stations 2 and 5 are also taken off, the knockouts at Station 2 adjusted, the stop *S* unseated and the dies at Station 3 inverted. The die at Station 4 is reversed to get the benefit of an identical cutting edge, at one regrinding, and inverted at the next, alternately. This is done to save the depth of the U-shaped clearance as much as possible. All dowel and screw holes at this station are interchangeable. With this arrangement, the grinding cut may be taken over the entire die as far back as the guide pins permit.

Fig. 3 is a cross-section of the piercing and trimming unit. The bearing plate *B* is made to take the thrust of the trimming cut. The hole goes clear through the bolster and is drilled and later trued by machine filing. The liner bar *L* has an angular clearance at this point to give the trimmer punch access to the die and to allow scrap to fall through. The gage is inserted to the depth indicated by the dotted line, the liner being undercut for a distance to allow this. The spring pad strips the piercing punches and holds the stock for the trimming cut.

In Fig. 4 is shown one of the shearing punches. It is relieved at *R* to preserve the bridge on the strip. At this point, there is also a slight shear on the punch, just enough to avoid kinking the strips. The stop *S* is seated in an undercut of the liner bar; while the knockout *K* is designed to take care of the entire width of the strip and yet not prevent the insertion of the spacers *P*.

The knockout is actuated by a strong spring from below. The die parts and the spacers are ground to the same width, the four together aggregating the width of one station. The punches and the knockouts are ground similarly, but with 0.001 in. on each for clearance.

The strengthening rib on the clip is formed at the third station. The die for this is shown at Fig. 5. The projection on the punch is turned on, but the mating groove in the die has to be milled out with a fly cutter. The projections on the punch are turned concentric, and the part not wanted is filed off. The illustration shows how the punches are held, also the knockout pins that lift the strip clear of the die while it is fed along.

The separating punch in Fig. 6 bears against the liner bar. The pilots *E* position the stock while the spring pad holds it. The half-round in the die is for clearance, so that the strip will slide through.

The reslitting operation was thoroughly explained in the plan view and therefore is not shown. The total blanking pressure is about 6 tons. The punches are ground staggering, the two punches at Stations 1 and 4 being left the highest, the piercing punches next, followed by the punches cutting cross-wise at Stations 2 and 5. The press should not be tilted because the pieces fall through the bolster better without this. The die has been in operation for several months and no troubles have occurred. The die is estimated to yield from 30 to 50 million cleats.

• NEXT WEEK •

Professor Norman of The Ohio State University has conducted a large number of tests on belting for various industrial concerns. Because much of this material is confidential, he was persuaded to run a special series of experiments for *American Machinist* and *Product Engineering*. The result of these, "Life Tests on V-Belts," will appear next week.

Hot galvanizing, its problems, and how the mechanical departments can aid in solving them will be described by Wallace G. Imhoff, an authority on the subject. "Taps and Dies for Self-Locking Threads" by our own Chester B. Lord tells of the unique tooling required for the Dardelet system.

Walter J. Oldroyd, in "Many Gages Make Precise Work," outlines four distinct systems of gaging and the application of each.

Other articles that will appear are: "Locomotive Shops in Australia," and "Pin Inspection of Tooth Profiles" by Sam Trimbath.

• IN A. M. •

IDEAS FROM PRACTICAL MEN

Pentagonal Gearing

R. E. MCCOY
Designer Industrial Heating Equipment
Westinghouse Electric and Manufacturing Company
Mansfield Plant

THE MECHANISM shown in Fig. 1 is part of the drive of a special offset printing machine for printing the numerals 0 to 9, inclusive, on the sides of the double pentagon illustrated in Fig. 2, one numeral being printed on each side. The odd numerals 1, 3, 5, 7, and 9 are printed on the faces at one end of the pentagon, while the even numerals 0, 2, 4, 6 and 8 are printed on the faces on the other end. It was necessary that the printing mechanism should operate without any backlash or slippage whatsoever, so that the printed numerals would have clear-cut sharp lines.

The two five-sided thirty-two pitch gears *A* were mounted on the drive shaft *B*. The lengths of their pitch lines are the same as the circumferences of the pitch circles of the gears *C* with which they mesh. The circumferences of the two five-sided cams *D*, mounted on the drive shaft, and the two circular cams with which they contact are the same as the lengths of the pitch lines of the gears *A* and *C*. The gears *C*, which drive the printing mechanism (not shown) and the cams *E* are mounted on the dovetailed sliding blocks *H* located on opposite sides of the drive shaft.

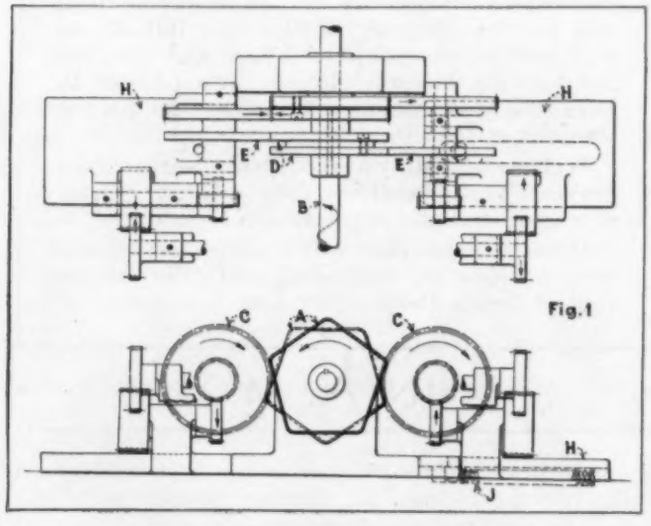


Fig. 1

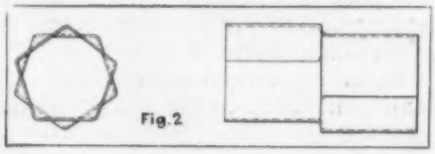


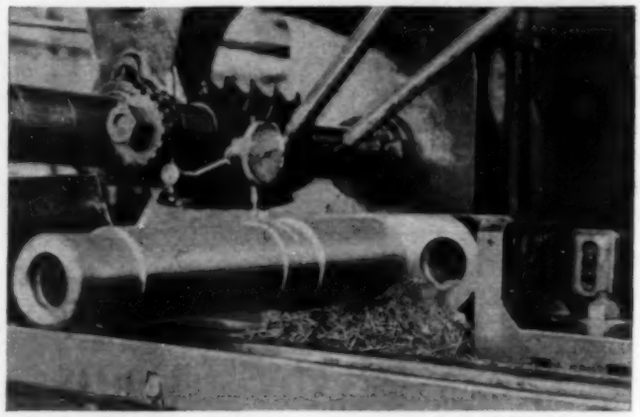
Fig. 2

When the drive shaft is revolved in the direction of the arrow, the compression springs at *J* keep the faces of the circular cams in contact with the faces of the five-sided cams at all times, Since the circumferences of the cams are the same as the lengths of the gears *A* and *C*, the pitch lines of these gears are always tangent to each other.

Using Indicator on Milling Work

HERBERT F. CRAWFORD

Crankshaft balance is especially important in airplane engines. This means that the crank cheeks must be central with relation to the shaft itself. By using a dial indicator as shown, it was easy to set the work



to permit milling an equal amount from each side of the crank cheek.

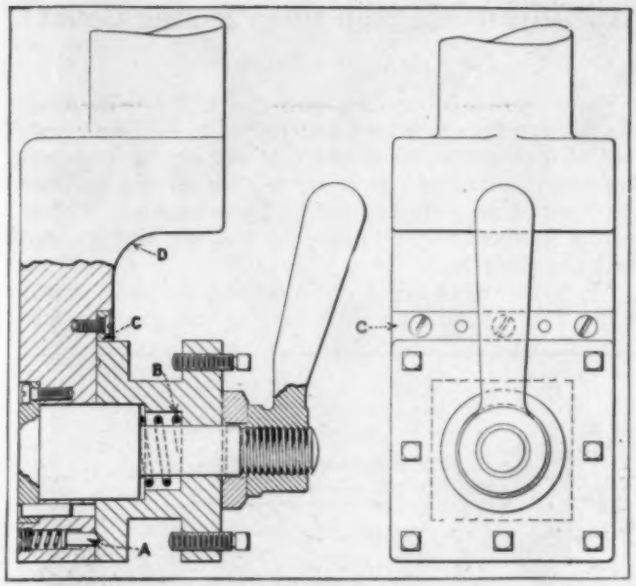
The shaft is held in the vise and can be leveled by using the indicator at different points on it. Then the work is set by a vertical movement of the table until the indicator shows the desired height. The shaft is then reversed in the vise, leveled if necessary, and the table again raised to the same height as shown by the indicator. As the indicator contacts with the shaft itself, the height must be the same on each side. Many other jobs can be centered in the same way by clamping the indicator to the overarm, or to any fixed point on the machine. This is used in the Kinner Airplane & Engine Co. shop, Glendale, Calif.

A Turret for the Boring Mill—*Discussion*

H. ROSE
Kilburn, London, England

The turret described by T. W. Aven in an article under the title given above (*AM*—Vol. 75, page 641) would, no doubt, greatly facilitate production on many classes of work, but there are some points in the design that should be altered to improve its efficiency.

For example, the turret spindle is screwed into the bracket formed on the end of the toolbar. Since the spindle must be unscrewed before each indexing, wear would soon develop and the accuracy would be impaired. Another point is that the spindle must be unscrewed for a distance exceeding the depth of the step that de-



termines the angular position of the turret, and the locating ball will then drop out of its hole. While Mr. Aven does not refer to the locating step in his text, it is indicated in his illustration. The spring under the indexing ball is not stiff enough to move the comparatively heavy turret clear of the step.

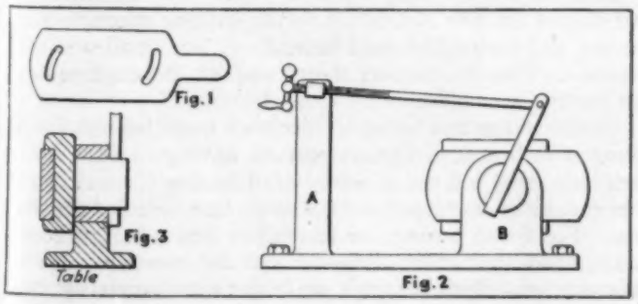
Some modifications are suggested in the accompanying illustration. The spindle is a press fit in the bracket and is secured by screws and dowels. With a spindle of this type a rigid clamping action is obtained through the usual clamping lever. The indexing ball is replaced by the spring-actuated plunger *A*. Another improvement is the addition of the heavy spring *B* to move the turret clear of the locating step when the clamping pressure is released. As a means of reducing wear, the hardened locating strip *C* is fitted to form a step. In addition to obtaining a good fit in the first instance, this strip enables a quick repair to be made by replacing it when the faces of the turret eventually wear. A generous fillet should be left at *D* to give increased strength to the bracket.

Milling Arcs With Offset Centers

HENRY C. FRANCIS

A small shop had a number of cam plates to make of the type seen in Fig. 1, the cams being in reality parts of a circle with the centers offset as indicated by the two slots. The job was done on a No. 2 Cincinnati miller using the rig shown in Fig. 2.

The device consists of a base plate with an upright *A* for a screw that moved the work and the support *B* for the workholder. A section of this workholder is seen in Fig. 3 which shows the bearing on which the work is turned and the way in which it is held.



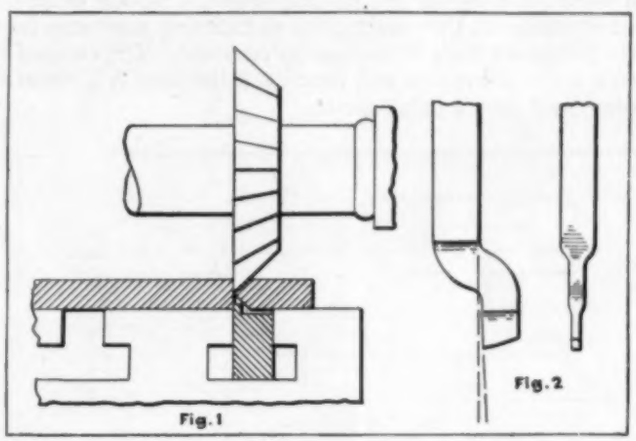
In using this device, it is necessary to locate two positions of the milling machine table that will bring the axis of the workholder above and below the center of the spindle of the machine, and in the positions at the centers of the arcs in Fig. 1. With the work properly located, the crank handle in Fig. 2 turns a screw through a swiveling nut on the upright support and swings the work through the proper arc.

A Small-Shop Kink—*Discussion*

H. HUMPHREYS
Maidstone, Kent, England

The method described by Charles H. Willey in an article under the title given above (*AM*—Vol. 75, page 898), for cutting an inch from the edges of steel plates may be improved upon in any of the following ways, using the machines mentioned. It is not necessary, even with limited equipment, to make a third operation on the edges that are wanted to be square.

To make the nearest approach to the boy's method as described by Mr. Willey; with a single-angle cutter the edges would have been left square. After the cut had been made on one side, it would have been a simple matter to have set two stops to catch the straight side of the cut when the plate was reversed, as shown in Fig. 1, and to have made the second cut meet it. A $\frac{1}{8}$-in. slitting saw could be used with safety in the following manner on an unsupported arbor: Place the saw as near to the inner end of the arbor as the work will permit. No key should be used in the saw, but one of the collars between



the saw and the nut should be keyed to the arbor. This would prevent the saw from being tightened if it should dig in.

Or if the saw is being revolved in the opposite direction, the nut would be prevented from coming unscrewed. The bottom of the saw should be set from 0.005 to 0.010 in. above the top of the table—it should not be allowed to break through the work. In fact, the saw should be kept over the solid part of the table rather than over one of the T-slots. Finally, work with the table as close to the machine column as is possible.

In regard to the shaper method, the swan-neck tool in Fig. 2 would, I think, have eliminated the digging-in trouble if the end of the tool were narrowed to about

$\frac{3}{16}$ in. in width and given a slight negative rake, keeping the cutting edge behind the back of the shank.

Whatever are the shortcomings of the method described by Mr. Willey, it is pleasant to observe that he has given the boy due credit for doing the job, and it is an example that could well be followed by more men in the higher ranks of our trade.

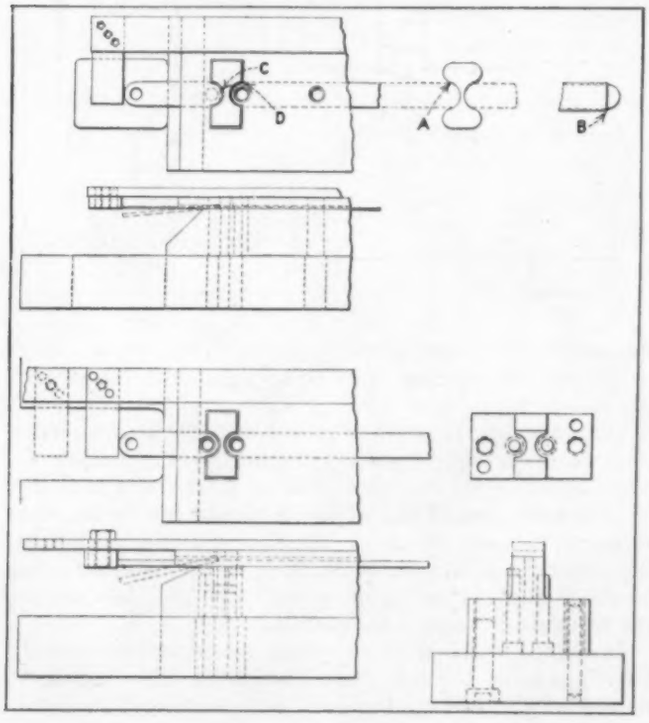
A Positive Unloading Device
Discussion

CHARLES F. KRAUT

In the device described by Forest L. Johnson in an article under the title given above (*AM*—Vol. 75, page 825), the plunger *B*, in his illustration is a clever thought. However, a jet of compressed air directed approximately at the spot where the plunger *B* contacts with the work would accomplish the same purpose.

Since slit or sheared stock, or stock having rolled edges, has a permissible tolerance of at least $\frac{1}{32}$ in., the face contour of both the parting punch and the die should be as shown at *A* in the accompanying illustration. This will prevent the ascending punch from hugging the parted blank at *D* and carrying it up. At the top is shown a set of parting tools having the same shearing action as shown in Mr. Johnson's design. As the parting punch ascends, the stripper plate *C* positively strips the product and also limits its tilting action, and prevents the advancing stock from passing under or over it. In this case, the advancing stock becomes a positive ejector.

In the tools shown in the lower view, the parting punch carries the piercing punches, one on each side. This design in conjunction with the adjustable stop gives one set of tools for piercing and parting products having different lengths. In this design, the obstructing gage stop in Mr. Johnson's tools is necessarily removed. The class of tools under discussion will function satisfactorily without being built into a pillar dieset.

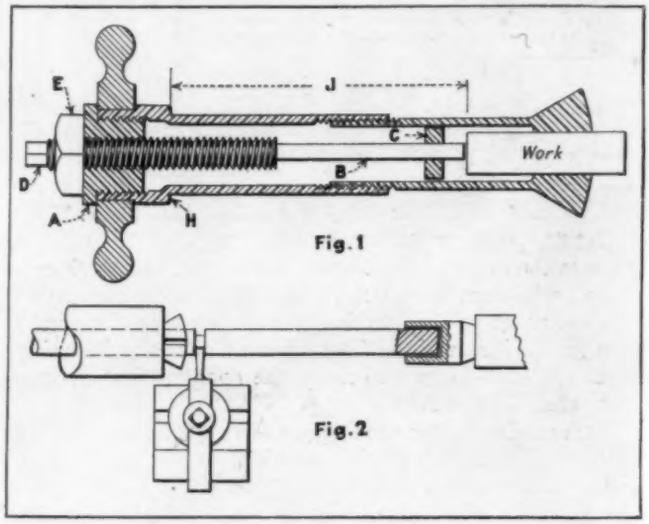


An Adjustable Stop for a Spring Collet

CHARLES KUGLER

The writer made the stop shown in Fig. 1 with which it is possible to cut off or face work to a uniform length. One of the executives could not see why a stop was necessary, so I asked him to try to face off to a uniform length six of the rods upon which I was working. Before he had finished two of them, he told me to go ahead and make the stop.

The special work necessary in making the stop consists in the nut *A;* the stop *B;* threading the draw-in tube



to suit the nut; and the collar *C*, which prevents the stop from vibrating while the lathe is in motion. Adjustment of the stop is made with a wrench at *D*, being locked by the nut *E*. Since the shoulder *H* must come into contact with the rear end of the lathe spindle when the work is tightened, the distance *J* is always the same. It follows that if the parts are placed against the stop and are faced off without changing the position of the tool, they must be uniform in length.

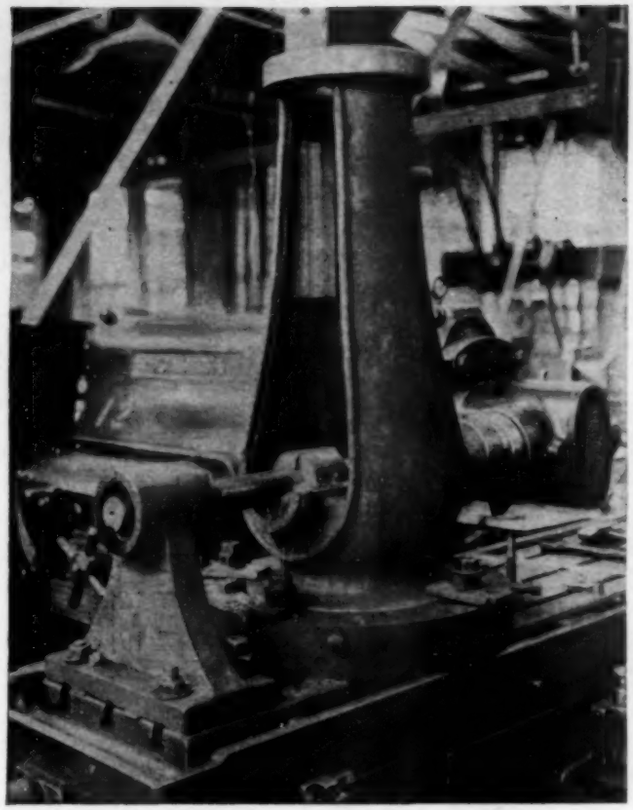
In the absence of a stop, I have used the method shown in Fig. 2, which enabled me to cut off, but not to face, stock to a uniform length. This device consists of a piece of steel turned to fit the taper hole in the tailstock spindle and bored to suit the work. While its utility cannot be compared with the stop shown in Fig. 1, it is much cheaper.

Boring in the Milling Machine

CHARLES C. TOMNEY
Chief Tool Designer, Brunswick-Kroeschell Company

Because our horizontal boring mills were overloaded, we rigged up our No. 3 Cincinnati milling machine for boring and facing the main bearings of our small vertical engines. The illustration shows one of the engines set up for the operation.

The bearings are bored to receive a large babbitt-lined removable bearing. On account of having to bore half bearings only, we use a cutter head having three cutters for roughing, leaving about 0.020 in. on a side for finishing. For finish boring, we use cutter heads having four cutters, so that their diameter can be measured by a micrometer. Both bearings are bored simultaneously, re-



quiring two roughing and two finishing cutter heads. The outboard bearing for the boring bar is fitted with roller bearings.

After completing the boring, the bearing studs are set and the caps, which are bored in a separate operation, are secured in place. The inner sides of the bearings and the caps are faced by a cutter head having three cutters projecting from each end.

The photograph from which the illustration is made was taken several years ago by an *AM* staff photographer who seemed to think that the set-up was an unusual one. I was machine shop foreman at that time and he presented me with a few copies of the photograph because of the assistance I had given him.

SEEN AND HEARD

JOHN R. GODFREY

That 56-Ton Machine

Who can help being interested in the ingenious machine shown on page 35, Vol. 76? But how many could be sold, or even used to advantage in the railroad shops of this country? It indicates careful designing and a world of good engineering thought, but from the dollar and cents point of view it couldn't pay dividends here. In a large railroad shop with few types of locomotives it might justify its cost, but I doubt if it could show a profit here. It reminds me somewhat of a large special machine built in an automotive parts shop to perform a large number of operations on a rear axle. It worked all right but it took longer to set it up than the number of axles warranted and the last I knew it was taking up valuable space, with the $40,000 it cost still on the books as an asset. There are too many similar cases of misplaced ingenuity to be found about the country, all of which have added to the huge list of frozen assets that we hear talked about.

Oiling Ball Bearings

Experience seems to indicate that ball bearings need a little oil but that too much may be as bad as none at all. A friend who built a supercharger to run about 40,000 r.p.m. had trouble both ways. Then he found a way of keeping a sort of oil mist in the bearings and his troubles were over. And he didn't blame the bearings when they failed, as would have been natural. He knew they ought to run O. K. and experimented until he found out how to do it.

Get the Most Out of Your Steel

According to one steel expert there is a lot of money wasted in using alloy steels. Not that he is opposed to alloy steels, far from it, he sells 'em. But he finds many cases where the term "alloy steel" acts as a sort of mental anesthetic and makes the user unconscious of the value of properly heat-treated carbon steel. Too many people, he says, pay a good price for alloy steel and use it annealed instead of heat-treating it. In such cases, he advises using carbon steel heat-treated of course.

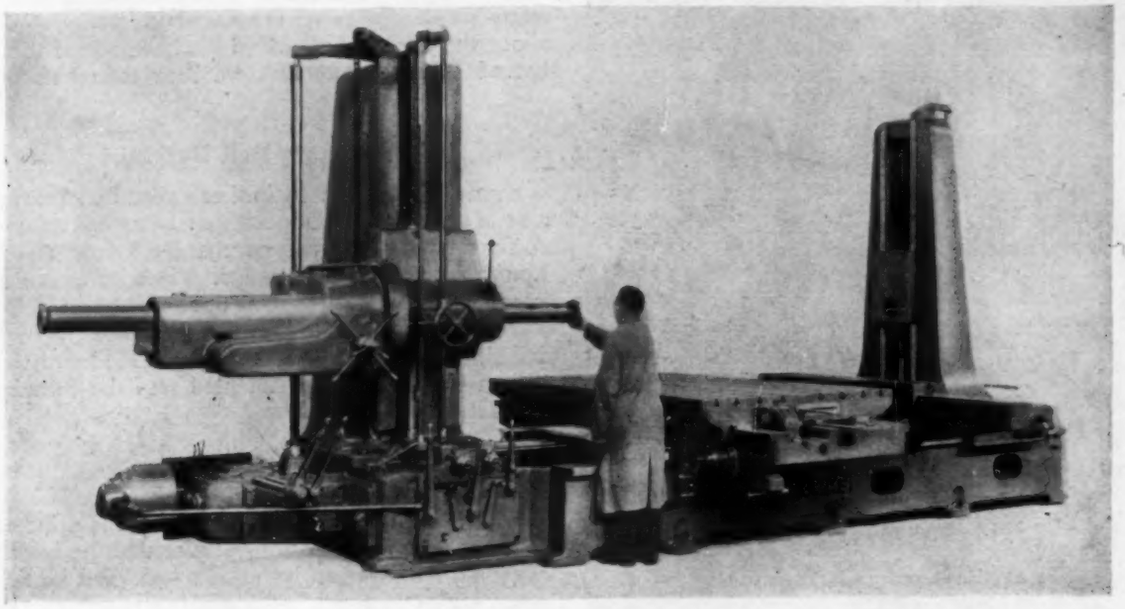
Furthermore, this steel man says that heating steel up to 500 deg. F. relieves all strains due to machining and that it is unnecessary to heat steel above this point to take care of the working stresses. Normalizing should be done at from 100 to 150 deg. F. above the usual annealing temperature.

Radical Changes in Automobiles

Discussion at the recent meeting of the Society of Automotive Engineers and many other signs point to many and radical changes in passenger car design in the near future, possibly to a complete transformation of the vehicle. Engines are likely to be placed at the rear of the car and the body, among other parts, to be much altered. New types of spring suspension are almost certain. Engines seem sure to undergo radical changes, and gearsets may be eliminated. If axles are not displaced entirely, they are certain to be changed radically. Frames, of course, will be altered to fit into the rest of the picture.

All of this means new opportunities for the shop and perhaps marked changes in the type of machine tools required. It is quite likely to be accompanied by the use of new materials and of new production methods. Let one prominent automobile manufacturer bring out a successful rear-engined car and the other will be quick to follow suit, for many are studying possibilities in this direction and some have experimental designs in progress. Cars today are too much alike. The industry needs the stimulus of something radically new. When it arrives it is sure to affect a considerable proportion of the metal-working shops of the country. So runs gossip in the automotive field, and it sounds pretty logical too.

SHOP EQUIPMENT NEWS



No. 53 Lucas "Precision" Horizontal Boring, Drilling and Milling Machine

A NEW SIZE of the "Precision" horizontal boring, drilling and milling machine, providing increased cross adjustment and vertical capacity for certain classes of work, is being manufactured by Lucas Machine Co., E. 99th St. & N.Y.C.R.R., Cleveland, Ohio.

The bed is a one-piece casting, extending beneath column and table to increase strength and rigidity. It is 60 in. across the ways, yet permits adjustment of the tools in the bar without the operator climbing onto the bed. Tool adjustment is also facilitated by recessing the lower part of the base for the operator's toes instead of using the usual projecting flange. Thus the operator can stand erect against the bed of the machine without any tendency to pitch forward. Outer ways are made to present a broad, unbroken bearing surface, concentrated as closely as possible to the outer edges of the bed to reduce unit pressure and consequent rate of wear, or tendency to cut. Adjusting screws provide support at close intervals on the foundation and facilitate accurate leveling, when setting up the machine and whenever correction may be required. Leveling pads on the column are also provided, to facilitate checking its squareness in both directions with the bed ways.

The saddle is guided, supported and clamped down in the middle of the top of the bed to resist any tendency toward sagging or counterflexure when the table is at the extremes of its travel. Clamping is by means of a lever located at the operating position, at the left, front corner of the saddle. Two simultaneously operated, vertical clamping bolts, at the left- and right-hand sides, bind the saddle down on the intermediate way of the bed. The saddle is of generous depth and width and 10 ft. long.

The table also has an intermediate support and guide on the top of the saddle, and is of heavy complete box-type construction to resist any strain put on it by clamping heavy work. A single lever at the front of the table simultaneously operates three vertical clamping bolts, located midway between the ends and at the two sides and center of the table. This construction rigidly locks the table against movement during a setting and maintains alignment, rather than tending to cramp or spring the members out of line. The table has a convenient provision for hand cross adjustment, at the sides of the front of the saddle. Automatic and centralized pressure lubrication is provided for the table and saddle unit.

The column has an unusually wide spread, measuring 42x40 in. where it bears on the top of the main bed casting, permitting strong internal ribbing and yet leaving room for the head internal counterweight.

The backrest can be removed readily from its base on the bed when necessary to accommodate extra long work. Provision is made, by means of a lever at the bottom of the backrest, for clamping the backrest block securely in position on its V-guides, at any height within its range of travel. All these castings are of iron, with 1-1½% nickel and 30-50% steel.

The spindle is of hardened Nitralloy steel to minimize wear and any tendency to score or stick in sliding through the bushed steel spindle sleeve, which is carried in adjustable anti-friction bearings to permit close adjustment and comparatively high speeds. The hardened alloy steel gears in the speed change gear box run in oil (as do the gears in the feed change gear box) and slide on multiple-splined shafts. The entire drive is carried in anti-friction bearings.

General specifications of the standard Lucas No. 53 machine are: Diameter of spindle, 5 in.; Morse taper hole in spindle, No. 7; traverse of spindle, 72 in. (2x36 in.); maximum distance faceplate to outer support, 8 ft.; maximum distance, top of table to center

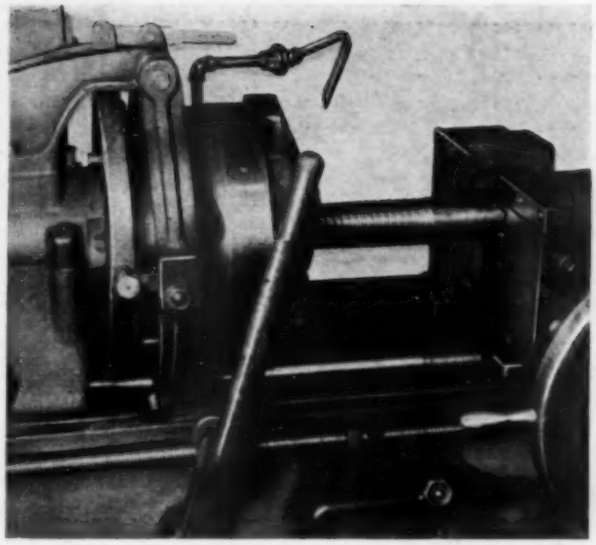
of spindle, 60 in.; distance, top of bed to top of table, 15⅞ in.; size of table, 48x96 in.; cross-feed to table, with automatic trip, 84 in.; number of speed changes, 18; range of speed (r.p.m.), 7½ to 220; number of feed changes (9 for each position of spindle back-gears), 18; range of feed (in. per revolution of spindle) 0.004 to 0.750 in.; speed of power rapid traverse, per min., 97 in.; diameter of constant speed driving pulley, 20 in.; width of driving belt, 4 in.; speed of driving pulley (r.p..m.), 500; shipping weight, about 50,000 lb.

A number of special parts and attachments can be furnished upon special order. These include special length beds, 10, 12, 14 and similar multiples of 2 ft. in length; special high column and backrest to give maximum vertical capacity of 72 in.; a wide table of standard length with 84-in. crossfeed 60x96 in.; dial indicator indexing device, cutting lubricant arrangement, vertical milling attachment to span the standard 8-ft. bed.

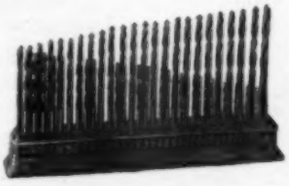
Extra attachments available include a circular swiveling table, square swiveling table, rectangular swiveling table, star feed facing head, inserted tooth face milling cutters, and auxiliary table. The swiveling tables are graduated and have an elevating ball thrust bearing interlocking with the single control clamping mechanism and with the indexing lockbolt for four positions 90 deg. apart. The 11-ft. auxiliary table has a slide 12 in. wide and 60 in. long, flush with the top of the main table for supporting long work overhanging at the side. The star feed facing head has a 30-in. diameter maximum capacity. Inserted tooth face-milling cutters can be furnished up to 18 in. in diameter.

Landis 4-In. Rotary Diehead with Roughing and Finishing Attachment

A new diehead having a capacity up to and including 4 in. in diameter and equipped with a roughing and finishing attachment has been developed by Landis Machine Co., Inc., Waynesboro, Pa., for use on the Landis 4-in. lead-screw threading machine. This diehead is recommended by the manufacturer for cutting coarse-pitch threads on valve stems, vise screws, jack screws and similar classes of work which require great accuracy and an exceptionally smooth finish. Roughing and finishing cuts are controlled by a latch mounted on the yoke bracket. Release of the latch, after the roughing cut is made, permits the diehead to close for a light finishing cut. The amount of metal removed during this cut is approximately 0.045 in.



No cutting strains are transmitted either to the diehead yoke or the roughing and finishing attachment. The diehead is locked within itself when set for either the roughing or finishing cut, thus making it possible to produce threads that are free from taper and uniformly accurate for size. A pitch indicator is employed to assist the operator in timing the engagement of the lead-screw nut for the finishing cut. This diehead can be used for cutting single, double, triple and quadruple threads from ¼ in. to 4 in. diameter with a maximum lead of ½ in.



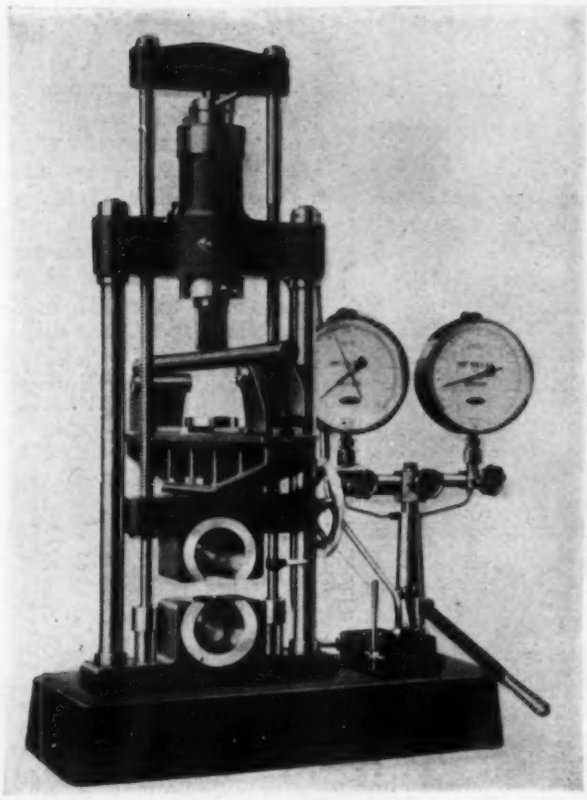
Cleveland Drill Sets in Metal Cases

Four drill sets in metal cases, two carbon and high-speed steel fraction-size drills, the other two carbon and high-speed steel wire-gage size drills, are now being manufactured by Cleveland Twist Drill Co., 1242 East 49th St., Cleveland, Ohio. Fractional-size sets include drills all jobbers' sizes from 1/16 to ½ in. by sixty-fourths, the wire-gage sizes drills from No. 1 to No. 60, all straight-shank types. A chromium-plated stand, 8¼x1¼x1⅛ in. and plainly marked with the drill sizes and decimal equivalents is included in each set. Carbon steel drills are packed in a black japanned metal box. High-speed steel drills are packed in a similar box lacquered red. Sets are numbered thus: Carbon-steel fraction sizes—No. 51; high-speed steel fraction sizes—No. 58; carbon steel wire-gage sizes—No. 52; high-speed steel wire-gage sizes—No. 59. High-speed steel set No. 58 and carbon steel set and stand 52 are illustrated.

Steel City Universal Hydraulic Type MP-10 Testing Machine

A moderately priced testing machine, Model MP-10, is being placed on the market by Steel City Testing Laboratory, 8843 Livernois Ave., Detroit, Mich., for testing specimens in tension, transverse, bending and compression. The machine is designed for use in foundries, sheet metal, wire, cable, and welding plants, also technical schools where a machine of low capacity (22,000 lb.) will suffice. Features of the apparatus are claimed to be finely fitted non-packed plunger, vertical adjustability of the upper pulling head, two measuring ranges, versatile applicability, easy of operation, space saving, convenient working height, and self-containedness coupled with accuracy.

The unit can be supplied either for hand or motor drive and permits easy determination of elastic limit, yield stress, tensile strength and elongation of all kinds of material. Meas-

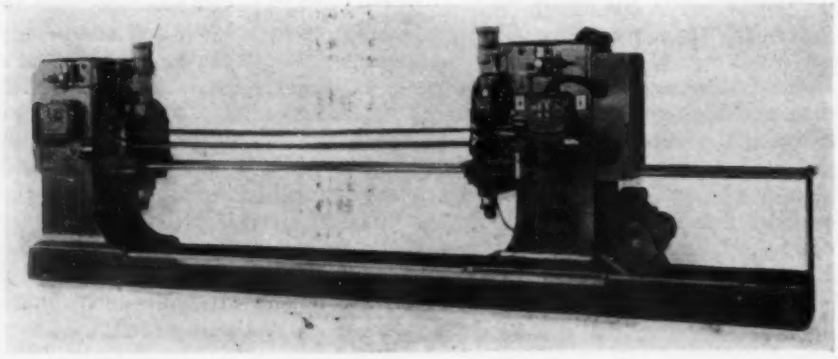


uring range of the pressure gages is 4,400 to 22,000 lb. Accuracy of load indication is ± 1 per cent. Distance between the clamping heads is 16⅛ in., and between the pressure plates, 13¾ in. Piston stroke is 4¾ in., and the width between tierods of the upper clamping head 8⅝ in.; over-all height of the machine is 54⅜ in., and floor space required is 13¾x33½ in. Weight with standard equipment is 665 to 900 lb. A variety of additional and special equipment is available.

Thomson-Gibb Electric Resistance Tube-Tin Soldering Machine

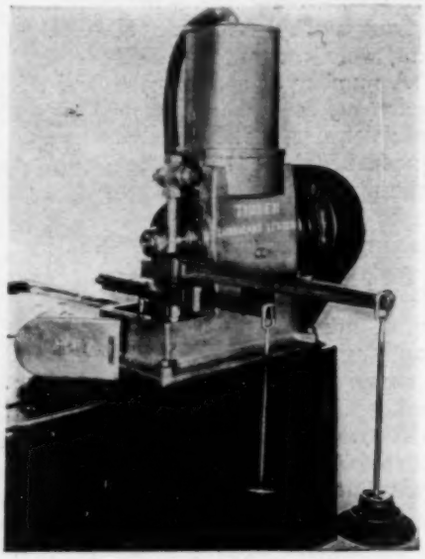
A special application of direct-controlled heating by the electrical resistance method, developed for rapid soldering of parts consisting of from 3 to 12 copper tubes on which are assembled a large number of flanged fins, is embodied in this machine by Thomson-Gibb Electric Welding Co., Bay City, Mich. Each fin must be soldered to each tube for good thermal contact. Tubes to be soldered are covered with solder, the fins assembled, soldering acid applied, the complete unit clamped in the machine, and current turned on. Clamping of the work is by means of air cylinders and all work clamping jaws are adjustable to provide for uniform clamping pressure and distribution of current to all tubes to insure uniform heating. The unit is actually two machines, one machine being fixed on the base and the other adjustable along it through a distance of 10 ft. by means of a motor-driven worm-reduction unit, spur gears and rack. The motor has reversible drum control. Adjustable time relays are provided to give definite work heating time. Each machine of the duplex unit carries its own transformer, one side of each secondary being connected to heavy busbars which form one side of the circuit, the work being heated forming the other side of the circuit.

According to the manufacturer, this method of direct-controlled heating by electrical resistance may be applied to many similar classes of work besides soldering, such as heating for annealing, heat-treating, heating for forging, bending, etc.



Timken Wear and Lubricant Tester

Accurate information on the load-carrying capacity of lubricants, measurement of friction, and wear characteristics of any kind of material has hitherto been obtained only on complicated laboratory apparatus. A new machine, however, manufactured by Timken Roller Bearing Co.,

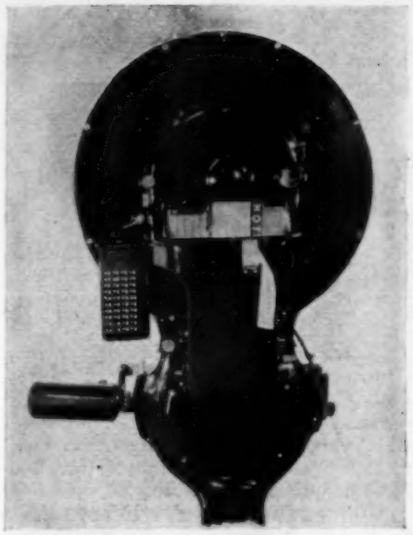


Canton, Ohio, is claimed to provide a simple, compact, inexpensive mechanism to perform all three of these functions. According to the manufacturer, no particular skill or training is necessary to produce accurate results. Over-all base dimensions are 8½ in. wide by 13½ in. long, by 22 in. high. The two lever arms increase over-all length slightly. Weight installed is 135 lb. The base is of cast iron with supporting feet cast integral, the latter being provided with $\frac{7}{16}$-in. bolt holes for mounting.

Improved Toledo Printweigh Scale

The Toledo "Printweigh" scale has recently been extended in use through three improvements: selective numbering device, delayed time switch and application of the photo-electric tube, or "electric eye."

The selective numbering device provides a system of identification with wide applications for dating, batch numbering, grading and numbering, by lot, by operators or by employee group numbers. It is a device composed of from one to four digits, symbols or letters. If desired,



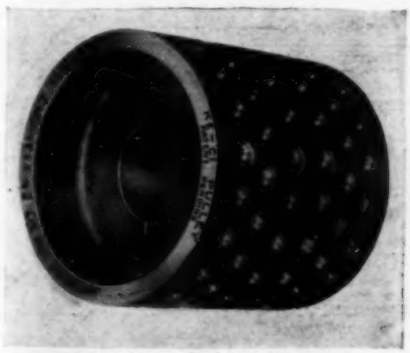
it can be furnished with decimal points or dashes to aid any system of plant control. The operator can punch the numbers or letters he desires, and these will then be reproduced on the weight ticket.

The delayed time switch simplifies use of the Printweigh in a conveyor system. As objects come down a conveyor line and move on a scale, the necessary moving makes the scale indicator oscillate. Hence, if the weight were printed at once, there would be a chance of inaccuracy. The delayed time switch delays printing of the weight until the indicator has stopped oscillating.

The electric eye makes the printing operation automatic if desired. Objects moving across the scale platform on a conveyor section may have their weight printed when they intercept a beam of light just before they leave the scale.

"Ke-Ci" Vacuum Cup Pulleys

A metal pulley with vacuum cups spaced over the face has been placed on the market by Keystone Engineering Co., Inc., 850 Maccabees Bldg., Detroit, Mich. As the belt reaches the cup the air in the cup is forced out. The atmospheric pressure against the belt then holds it firmly against the pulley base to minimize slip, according to the manufacturer. Pulleys are available with a setscrew and standard keyseat in sizes from 3 to 16 in. in diameter by 2 x 14-in. face.

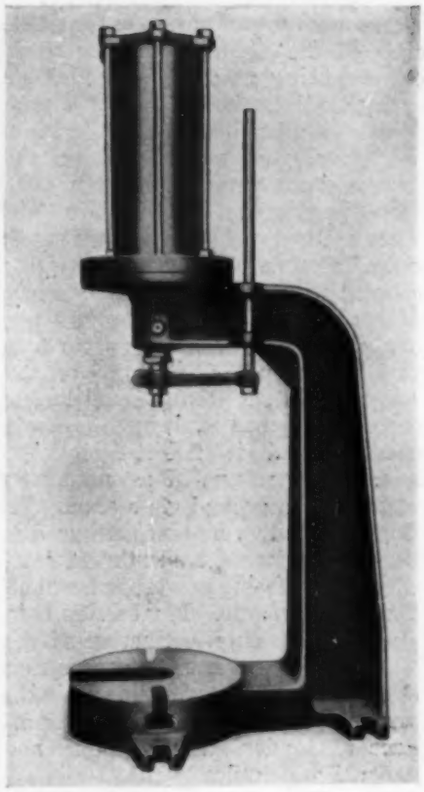


Lovejoy Side or Straddle Milling Cutter

For use where side space is limited and available either right- or left-hand, a new form of side milling cutter has been developed by Lovejoy Tool Co., Inc., Springfield, Vt. It embodies the company's original positively locked blade, mechanism, and has a blade adjustment of approximately one-half the total blade length to compensate for wear and grinding. Blades in the cutter are also new in shape and may be of standard or cobalt high-speed steel, Stellite, Stellite "J" metal, or tungsten-carbide. Bodies or housings are of heat-treated alloy steel.

Hannifin No. A-1 Air-Operated Arbor Presses

With a distance from table to ram of 11 in. and from center of ram to back of throat of 8 in., a new line of air-operated arbor presses incorporates more generous throat dimensions.



The line is designated as Series A-1 and is being manufactured by Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. The series is furnished in five sizes to deliver pressures ranging from 565 to 6,280 lb. at 80 lb. air pressure. Any length of stroke may be specified up to 10 in. Cylinder bores vary from 3 to 10 in. Frames in all sizes are of cast steel to assure the required rigidity. Provision is made for guiding the ram to prevent turning. Also the ram is supported in an extra long bearing. The presses may be obtained with either hand- or pedal-operated control valves.

Davey Model S-2 Vibrometer

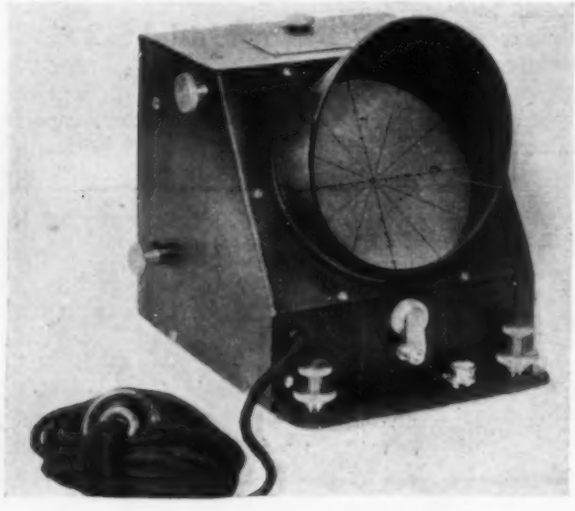
A Model S-2 vibrometer, capable of measuring vertical and horizontal vibration simultaneously, is being manufactured by Electrocon Corp., 6 Varick St., New York, N. Y. It is simply set upon the object whose vibrations are to be measured, and a spot of light traces out the exact path of the vibration, magnified many times, on a ground glass scale. The unit will measure frequency and phase position in addition to amplitude if used in conjunction with Davey portable balancing equipment.

The instrument works on the principle of the Seismograph, the main element being a weight suspended on springs. When the instrument is subjected to vibration above a certain frequency, this weight will remain inert in space, partaking of no motion from the vibration in either direction. The method of suspension used makes possible use of a light weight, coupled with a low natural frequency of oscillation of less than 100 per minute. A small concave mirror carried on a spindle is mounted on the weight and light from a small incandescent bulb passes through a small aperture and is reflected by the mirror in the form of a round spot of light on a ground glass scale. To magnify relative motion between the weight and frame, a silk thread fastened to the frame is wrapped around the mirror spindle. If vibration is in one direction only, oscillation of the spot of light will make it appear as a straight line in that direction. Vibrations equal in both directions will produce a circular track of light, and unequal amplitudes in the two directions will produce an elliptical light track.

The instrument will indicate accurately amplitudes of vibrations of frequencies above 400 per minute up to approximately 6,000 per minute. Good comparative readings may be obtained at frequencies below 400, but to obtain actual amplitude of these vibrations the instrument must be calibrated. The instrument is supplied in two standard sensitivities, Model S-2A, which magnifies vibrations approximately 500 times, and Model S-2B, which magnifies approximately 250 times. Special sensitivities may be supplied.

A standard film holder is supplied with each instrument so that photographic records may be obtained of repeating vibration. When supplied with a Neon tube, the instrument may be used in conjunction with the Davey portable balancing equipment.

The weight of the unit is 8 lb.; height, 7 in.; length, 7½ in., and width, 5½ in.



• PATENTS •

APRIL 26, 1932

Metal-Working Machinery

Oilproof Spindle End. David C. Klausmeyer, Cincinnati, Ohio, assigned to The Cincinnati-Bickford Tool Co. Patent 1,855,193.

Extruding Die for Bolts and Screws. Arch S. White, Library, Pa., assigned to Neely Nut and Bolt Co. Patent 1,855,372.

Acetylene Lamp. William F. Hunt, New Brighton, and Hermann C. Stelling, Haworth, N. J., assigned to Oxweld Railroad Service Co. Patent 1,855,395.

Molding Machine. William H. Nicholls, Old Westbury, N. Y. Patent 1,855,409.

Hydraulic Press. Harry F. Vickers, Los Angeles, Calif. Patent 1,855,434.

Method and Machine for Working Metal. James W. Hughes, Philadelphia, Pa., assigned to Budd Wheel Co. Patent 1,855,449.

Flask Shake-Out. John F. Crawford, Racine, Wis., assigned to J. I. Case Co. Patent 1,855,474.

Automatic Shaper. Oscar Onsrud, Chicago, Ill., assigned to Onsrud Machine Works, Incorporated. Patent 1,855,528.

Lapping Machine. Frank O. Hoagland, West Hartford, and Arthur L Wilder, Wethersfield, Conn., assigned to Pratt & Whitney Co. Patent 1,855,631.

Machine for Generating Curved Gear Teeth. Guy L. Bayley, Detroit, Mich., assigned to Bevel Gear Grinding Co. Patent 1,855,662.

Broaching Machine. Francis J. La Pointe, Ann Arbor, Mich. Patent 1,855,766.

Die-Casting Machine. Charles A. Wood, Clay Center, Kans. Patent 1,855,783.

Apparatus for Forming Articles in a Multiple-Spindle Screw Machine. John S. Stull, Chicago, Ill., assigned to Western Electric Co., Incorporated. Patent 1,855,874.

Apparatus for Forming Artices in a Multiple-Spindle Turning Machine. John S. Stull, Chicago, assigned to Western Electric Co., Inc. Patent 1,855,930.

Shear Corrugating and Grinding Machine. Frank Gorecky, Pittsburgh, Pa. Patent 1,855,957.

Tools and Attachments

Expanding Tool. James Ralph Tumblin, Fountain Inn, S. C., assigned to T. D. Wood. Patent 1,855,430.

Mechanical Hammer. Rudolf Goldschmidt, Charlottenburg, Germany, assigned to Nathan Kahn. Patent 1,855,446.

Chuck. James W. Hughes, Philadelphia, Pa., assigned to Budd Wheel Co. Patent 1,855,450.

Rotary Tool. David B. Miller, Greenfield, Mass., assigned to Millers Falls Co. Patent 1,855,456.

Hand Tapping Device. Charles D. Gaudreau, Springfield, Mass., assigned to Bay State Tool & Machine Co. Patent 1,855,479.

Milling Cutter. John Edgar, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,855,511.

Roller Stock Pusher for Screw Machines. Edward R. Dingell, Detroit, Mich. Patent 1,855,515.

Thread Rolling Die. Lee A. Frayer, Kent, Ohio, assigned to Roy H. Smith. Patent 1,855,668.

Cutting Indicator Attachment for Lathes. Clarence C. Wieser, Chicago, Ill. Patent 1,855,700.

Fluid Pressure Tool. Gustave M. Neill, Detroit, Mich., assigned to Chicago Pneumatic Tool Co. Patent 1,855,723.

Gas-Driven Riveting Hammer. William Luxmore, Chicago, Ill. Patent 1,855,805.

Molding Die. Randall Gillis, La Grange, and James C. Morison, Berwyn, Ill., assigned to Western Electric Co., Incorporated. Patent 1,855,855.

Cutting Tool. William Henry Shortell, West Haven, Conn., assigned to Millers Falls Co. Patent 1,855,873.

Metal-Cutting Tool (for a lathe). Austin J. Kilmer, Roseville, Mich. Patent 1,855,971.

Processes

Coating Material for Metal Articles (70% zinc, 30% cadmium). Rudolf Auerbach, Berlin-Neuenhagen, Germany, assigned to Wilhelm Steinhorst, Leipzig, Germany. Patent 1,855,377.

Process of Carburizing and Carburizing Composition. Carleton B. Edwards, Indianapolis, Ind., assigned to Peter C. Reilly. Patent 1,855,389.

• TRADE PUBLICATIONS •

CIRCUIT BREAKERS. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued two eight-page, illustrated circulars on its new line of "De-ion" circuit breakers recently described. Circular 1939 contains a general description of the new breakers, breaker ratings, and their applications. Circular 1937 gives construction and application of the 225-amp. breaker.

DRILLING & CENTERING. Sundstrand Machine Tool Co., Rockford, Ill., has prepared a new bulletin on the No. 56 drilling and centering machine described in *American Machinist* some time ago. The bulletin includes design elements, specifications and some examples of the work handled by the machine.

ENGINEERING SERVICE. A new bulletin "On time and in operation one hour after arrival," by City Machine & Tool Works, East Third at June, Dayton, Ohio, describes the field engineering service provided by the company. The title of the bulletin is derived from an actual job performed for Lycoming Mfg. Co. in connection with the new 12-cylinder Auburn engine.

LATHES. A two-color booklet, Circular No. 8, illustrating and describing the newly developed 8-in. Junior shop lathe manufactured by South Bend Lathe Works, 426 E. Madison St., South Bend, Ind., has been published by the company. Reference is also made to 300 detailed working blueprints and shop plans made to show mechanics how to do various operations. Copies are available by mentioning the name of *American Machinist*, from the Technical Service Dept., South Bend Lathe Works, South Bend, Ind.

ROUND LEATHER BELTS. J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia, Pa., has issued a new bulletin on its newly developed Tannate Special Rounded Belt.

SPOT WELDERS. A 24-page bulletin illustrating and describing the "Speed" Spot Welders, manufactured by Eisler Electric Corp., 744-772 South 13th St., Newark, N. J., has been issued by the company. Design elements of spot welders and a description of the butt welders made by the company are also included.

TESTING EQUIPMENT. Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., has just issued Catalog 50, Part "H," on miscellaneous testing machines manufactured by the company. It includes information on testing machines for cutting tool, oil, grease and bearing metal efficiencies, endurance, fatigue, impact, torsion, ductility, hardness, cold bend and shear testing.

TOOLS & GAGES. Taft-Peirce Mfg. Co., Woonsocket, R. I., has issued another edition of the Taft-Peirce Hand Book containing information on the company's precision tools and gages and also describing nine new developments by the company, including centers, blocks, angle plates, Electrocator, gear gage—limit snap gage, Demagnetizer, thread rolling dies, cutters and magnetic chucks. Also included is a section on contract service provided by the company.

TOOL-ROOM LATHES. Monarch Machine Tool Co., Sidney, Ohio, has issued a bulletin on "Monarch Model 'C' Tool-Room Lathes," containing 24 exceptionally fine illustrations showing Monarch lathes and their applications and the care used in their manufacture.

Horsepower Required For Turning and Boring

P. R. GUIRL

The chart on the next page was prepared from the formulas:

$$hp. = \frac{230{,}000\, DF^{1.55}\, rnT}{63{,}025\, E} \text{ for steel, and}$$

$$hp. = \frac{CD^{1.55}F^{.86}\, rnT}{63{,}025\, E} \text{ for cast iron}$$

These formulas were derived from the following, by Taylor,

For steel: $P = 230{,}000\, DF^{1.55}$
For cast iron: $P = CD^{1.55}F^{.86}$

Where:

P = Tangential pressure on tool in lb.
D = Depth of cut in in. (one tool)
F = Feed per revolution, in in.
C = Constant, 45,000 for soft C. I. to 69,000 for hard C. I.

$$P = \frac{Q}{r} \text{ where } Q = \text{Torque} = \frac{63{,}025 \times hp.}{rn}$$

r = Radius or distance from center to tool point
n = r.p.m.

For steel:

$$(1)\ P = \frac{63{,}025 \times hp.}{rn} = 230{,}000\, DF^{1.55}$$

and

$$(2)\ hp. = \frac{230{,}000\, DF^{1.55}\, nr}{63{,}025} \text{ for one tool, at 100 per cent efficiency}$$

For any efficiency or number of tools:

$$(3)\ hp. = \frac{230{,}000\, DF^{1.55}\, rnT}{63{,}025\, E} \text{ where}$$

T = Number of tools
E = Efficiency of drive mechanism.

For Cast Iron:

$$(4)\ P = \frac{63{,}025 \times hp.}{rn} = CD^{1.55}F^{.86}$$

And:

$$(5)\ hp. = \frac{CD^{1.55}F^{.86}\, rn}{63{,}025} \text{ for one tool, at 100 per cent efficiency.}$$

For any efficiency or number of tools:

$$(6)\ hp. = \frac{CD^{1.55}F^{.86}\, rnT}{63{,}025\, E} \text{ where}$$

T = Number of tools
E = Efficiency

The values of C in Formula 6 are 45,000 for soft cast iron and 69,000 for hard cast iron and somewhere between these values for medium grades of iron.

The value 230,000 given in Formula 3 does not vary much for soft steel or hard steel of usual common grades, but should be increased somewhat for steels of unusually close grain structure.

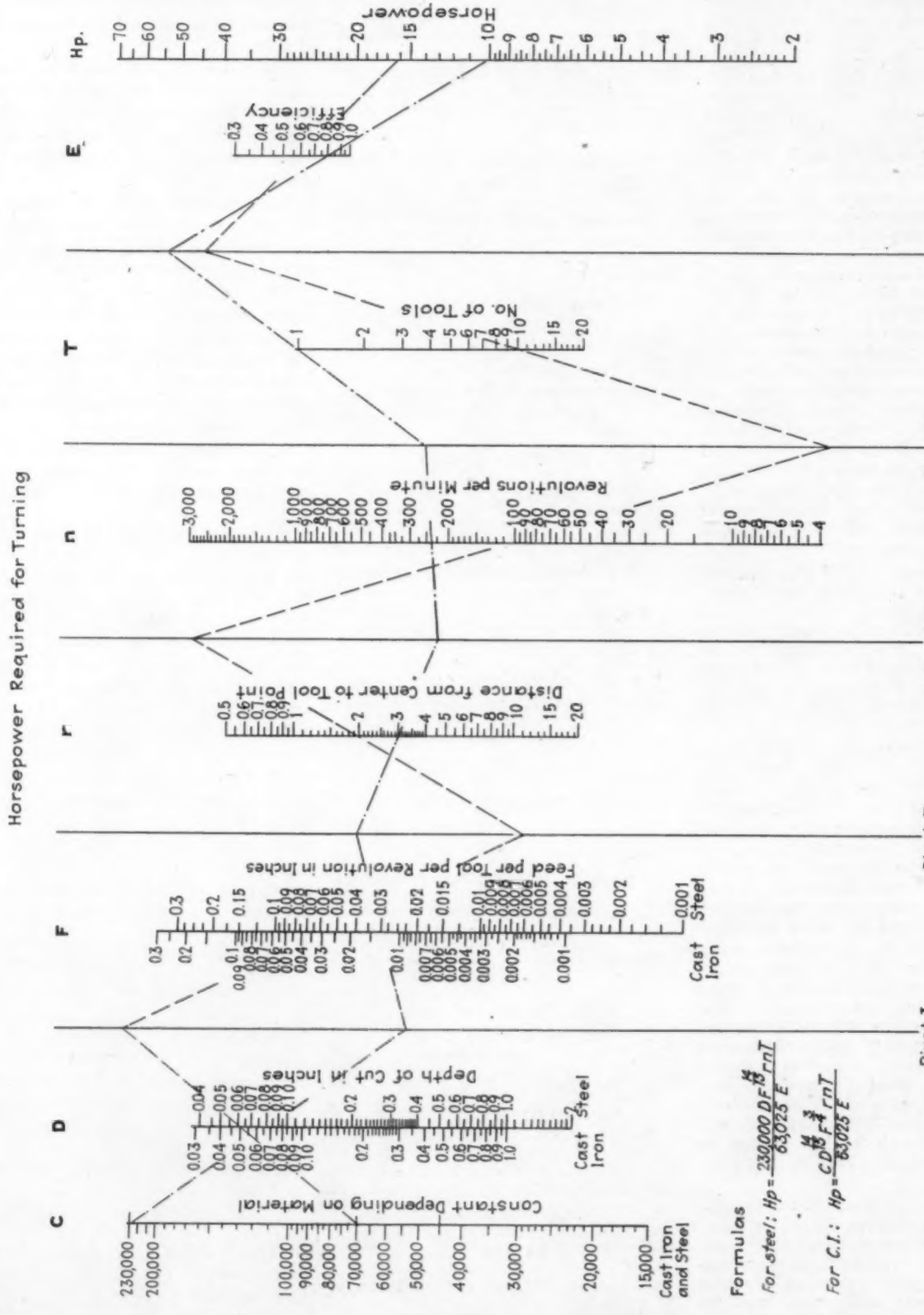
Although the formulas and chart are theoretically true only for turning, results obtained from their use check closely for boring.

Two examples are shown on the chart, one for cast iron (broken line) and one for steel (dot and dash line). An explanation on these two examples will serve to illustrate the use of the chart. A hard cast iron bar 4 in. in diameter is to be turned (or a 4 in. diameter hole is to be bored in hard cast iron). The depth of cut, D, is 0.05, the feed per revolution, F, is 0.03, the radius, r, is $\frac{4}{2} = 2$, the r.p.m. n is 100, number of tools, T, is 1, efficiency, E, is 60 per cent.

Connect 69,000 on C with 0.05 on the left-hand side of D and register on pivot No. I. Connect this point with 0.03 on the left-hand side of F, and register on pivot No. II. Connect this point with 2 on r, and register on pivot No. III. Connect this point with 100 on n line and register on pivot No. IV. Connect this point with 10 on T (instead of 1 to prevent going beyond the chart) and register on pivot No. V. Connect this point with 0.60 on E and read 16 on the hp. line. The proper result is $\frac{16}{10} = 1.6$ because the use of 10 on line T multiplied the result by 10.

The example for steel is solved in the same manner. *Example:* A bar of steel 6 in. in diameter is to be turned, the depth, D, of cut is 0.08, the feed per revolution, F, is 0.03, (note these two values are on the right-hand side of lines D and F). The distance from center to tool point, r, is $\frac{6}{2} = 3$. The bar revolves at 240 r.p.m., therefore $n = 240$. There is only 1 tool, or $T = 1$. The efficiency, E, is taken at 80 per cent. The result is 10 hp.

HORSEPOWER REQUIRED FOR TURNING AND BORING



Explanation of derivation and use of this chart on preceding page
(Contributed by Paul R. Guirl)

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EDITORIALS

May 5, 1932

K. H. CONDIT • F. H. COLVIN
Editors

Handicapping Management

Reliable reports from Russia indicate that production is coming along better than seemed likely a few months ago. Not that it is up to schedule as this was hardly to be expected any more than that the majority of golfers should reach par the first few years.

The most gratifying feature of the progress being made is that the Soviets are coming to realize the necessity of sane management and that the expulsion of the managing class in the early days was a serious blunder which has cost them dearly. Management is now recognized as the greatest single factor in carrying out plans of any kind, and it is being rewarded and given more authority.

There is a lesson in this change of attitude which some organizations of capital might well consider. Many high managerial executives in this country are handicapped by rules and restrictions imposed by those who control the finances but who know nothing of plant operation. This leads not only to discord but to actual losses in the operation of many plats. It is time that the value of plant management was fully recognized in our own country.

In the Dark

Imagine our surprise when in visiting the plant of a well known tool manufacturer the other day, we ran across an old fashioned gloomy heat-treating department. The windows and skylights were deliberately painted black in the approved prewar manner. In the good old days, we had grown quite adept at keeping out of quenching baths and lead pots in the various blue rooms and dark rooms that beclouded the locale as well as the subject of heat-treatment.

Just as old as the twilight itself were the reasons given for it: "to permit the heat-treater to judge his temperatures without confusion and eyestrain . . . pyrometers used for check . . . depend on the judgment of a good hardener rather than instruments." Having ourselves spent many a patient hour converting blacksmiths to the modern view of heat-treatment, we know all the stock arguments against these statements. Since then the development in recording instruments, signal lights and automatic heat control has progressed so far that we thought the old opposition had finally capitulated. But here's one hardening room that has not, and possibly there are many more.

We've seen men who claimed they could guess steel temperatures within ten degrees but never one whose eye could successfully compete with a pyrometer in a real test. We've passed the point where we check micrometer measurements by ocular inspection. But apparently some have yet to be convinced that the human element is more fallible than the instrument in temperature control.

Spending a Dollar to Collect Fifty Cents

Billing and collecting small charges for repairs and parts is usually expensive. In one small plant we know of, the accounting methods imposed by the holding company under which it operated made it cost about an even dollar to enter charges, bill, collect, and handle the remittance on any item. Being unable to secure a modification of the system, the manager decided to save money by not billing any items under a dollar.

Small repairs that would normally have been charged at fifty or seventy-five cents were given to the customers without charge. The policy actually saved money for the plant, and in addition, built up a lot of customer good will that counted in securing fair-sized orders in a number of cases.

The accountants were much disturbed by such

an unorthodox procedure but could offer no good reason for spending a dollar to collect a fifty-cent bill. As there is likewise no good reason for relieving customers of even small charges, it seems to be up to the accounting department to devise a simple system by which small items can be taken care of at lower cost.

• CHIPS •

Taking the bit in its teeth, the House runs away, ignoring all leadership . . . upsets both Administration and Congressional plans for economy . . . retains only $42,000,000 of original $225,000,000 saving program . . . Meanwhile the Senate continues its appropriation amputations . . . State, Justice, and Commerce departments come under knife to the tune of $12,500,000 below House allowances . . . Treasury-Post Office, Army-Navy expenditures next in line . . . Secretary Adams lists eight Navy yards which may be shut down . . . Flat 10 per cent cuts less trouble than a real program . . . Coal and oil import taxes removed from Revenue Bill by Senate committee . . . Income taxes doubled . . . Power of tariff regulation under flexibility clause may be lost by President . . . International conference on tariff reduction included in amendment . . . "Favored nation" policy by U. S. may be answer to French discrimination.

> The next problem is what to do with the short sellers. One reader suggests that since they alone have shown foresight during this depression it would be fine if we could persuade some of them to enter public life—to run for the Senate perhaps.

Secretary Mills advocates inflation of credit not currency . . . Federal Reserve helps by record bond purchases . . . $113,000,000 worth in one week . . . Hoover tells State governors that competition for new tax sources is stifling business . . . New bill would cut annual immigration quota from 261,328 to 72,620 . . . Speaking of benefits to war veterans, Representative Hawley says, "Sherman was just half right, he should have included peace."

Electrical industry may lead U. S. out of depression according to certain Washington economists . . . air-conditioning an important factor . . . Car loadings up 21,923 in week . . . 7,642 locomotives, 209,272 freight cars in need of classified repairs . . . 45 bank suspensions lowest for March since 1925 . . . Daily average of building contracts rises sharply . . . Business scales down book values . . . lessens fixed charges . . . paves way for future profits . . . I. C. C. warns railroad to cut fixed charges . . . indicates that loans may be withheld if financial fences of carriers are not mended.

Left wing gains in French elections . . . Tardieu's majority weakened . . . U. S. concerns in France relieved of double tax by Tardieu-Edge agreement . . . London still world's financial capital says President of British Board of Trade . . . Meat and wheat taxes threaten Cabinet harmony . . . Bicycle business booms in Germany as people balk at car prices . . . Throne Holst, Norwegian industrialist, favors continuance of low tariff policy . . . Italy willing to sacrifice $11,500,000 annually for general war debt cancellation . . . Railroad across Andes urged in Peru . . . Dnieprostroy, Soviets' Boulder Dam, delivers first power.

> Resourcefulness in applying plant capacity to new uses has been commended of late. But even this can be carried too far. In a Belleville, N. J., tool shop, Federal agents seized a 20,000-gallon still and nine 10,000-gallon vats of mash.

Ford, visiting Hoover, says he is selling all the cars he can make . . . 50,000 goal set for May as mechanical difficulties are overcome . . . Plymouth shipments rise 35 per cent in week . . . General Motors gets $300,000 contract for 60 buses for Chicago Fair . . . Largest auto production for 9 months seen for May . . . 170,000 units estimated . . . Simpler, lower-priced cars in prospect . . . Chicago firms avoid layoffs by adjusting wages to monthly business . . . employees help boost sales . . . First quarter Westinghouse orders 50 per cent over 1931 . . . DeLaval has turbine orders to keep shops running full time the rest of year . . . 1,100 men put to work in Decatur shops of Wabash R.R. on the strength of Reconstruction Finance loan . . . Auto Compressor Co. gets order for 10,000 refrigerator units . . . United Action Drive to put 1,000,000 to work reports 668,607 employed . . . in 2,744 towns and cities . . . Reo shipments of cars and trucks for April are 28 per cent over last year . . . Kelvinator and Leonard electric refrigerator sales up 10 per cent over April 1931.

· REGIONAL · REPORTS ·

WITH the single exception of New York, reports of machine tool activity from all over the country indicated that the bottom of the ladder was reached in April. How long the market will remain there many are willing to guess but no one knows. There has been no heartening progress in the automotive industry though Ford is reported to have finally released long-awaited orders for supplies from accessory makers. The Navy and other government bureaus still continue to call for bids. Industrial concerns, most of them operating far from capacity, find little need for tools though their equipment continues to wax obsolete and inefficient.

NEW YORK finds itself the only bright spot in the country with several dealers reporting April considerably better than March. New England continues dull, finding some consolation in Navy orders. April showered nothing but gloom on Chicago. Cincinnati was dull, and Detroit grows daily more pessimistic. Milwaukee started April hopefully, but the weak upspring of business was founded on the false hope of an automotive increase. Philadelphia reports nothing stirring, except inquiries.

NEW YORK—April closed here with several dealers reporting better sales than for March. One dealer's business was up twenty-five per cent and another declared April business far better than March and this week much better than last. Ford releases on supplies resulted in the closing of several orders for tools. Word of Navy awards is awaited on bids closed during April. Bids closed last week on lists for vocational training departments of schools in Albany and Hastings. Sheet metal work continues fair, and several firms in this line have made purchases of tools. The week was better than any other period for some time although not all dealers shared the advance.

NEW ENGLAND—The machine tool market is abnormally quiet, and April closed out with a dearth of orders. The Navy continues to radiate a few bright spots. Other industries are taking only an occasional tool as absolutely required. The automotive field is still the focus of all expectations. Rebuilt equipment is dormant.

CINCINNATI—One manufacturer of lathes booked several small orders and had a larger number of inquiries during the past week. Taking the trade as a whole, however, there was no increase in the volume of sales.

CLEVELAND—Sales of tools for April were way below those for any other month this year. February was the top month. Sales were practically at a standstill the past week. New inquiries were dormant. Consummation of several orders depends upon continued steady production by automobile manufacturers. Foote-Burt Co. business showed a profit for the first quarter.

PHILADELPHIA—No change in the situation during the past fortnight. Manufacturers and sales agencies do not look for any immediate improvement. Inquiries took a firmer tone than previously but no important orders were closed.

CHICAGO—This district heaved a sigh for the passing of April as the deadest month in several years. There are those who believe that the turn is at hand, while others heave another sigh to think of what may come before this summer ends. One expensive machine was sold during the week to a watch case company and Westinghouse Elevator continues to take a machine now and then. Rockford is in the doldrums.

DETROIT—Large machines for mass production in the auto industry show more sustained activity than any other type. Sales of general equipment, and of machine tools and fixtures, are almost nil and when they do occur, the price demanded for the turn-in is almost prohibitive. Ford is still making occasional purchases of production machinery, has advanced production to 42,000 cars a month, reemployed many workmen, and released large orders for steel and other materials. Chevrolet has boosted production 750 a day. Chrysler has reached a total production of nearly 1200. Hudson is making important changes in its production methods but is not purchasing new equipment and does not plan to purchase any. General business is increasingly pessimistic. April was drab and May is likely to be as bad.

MILWAUKEE—Both inquiries and orders dropped to new lows at the end of April. The slight improvement noted earlier in the month failed to be maintained. Some small, scattered orders have been placed. Apparent failure to revive retail automobile buying has shattered the hopes for early tool purchasing from that source as well as from many allied industries. One manufacturer of special machines reports continued fair business and there is a feeling that the bottom has finally and unmistakably been struck.

MATERIAL TRENDS AND PRICES

Plates and sheets continue to lead in the small amount of steel buying now in evidence. Bar business is coming largely from highway needs, neither railroads nor agricultural implement makers offering outlets for appreciable tonnages of soft steel bars. Prices continue dormant in finished material. Tin advanced during the last week. Prices of copper and zinc, however, dropped slightly. The scrap market, which has shown little change of late, has finally turned slightly downward in Cleveland and Chicago. New York scrap prices hold.

(All prices as of April 29, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00	$11.00	$12.00
Buffalo, No. 2, Fdry., per gross ton	16.00	16.00	17.10
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	9.75	10.00	11.25
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.50
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb	1.50@1.60	1.50@1.60	1.65

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago 4.62½	Cleveland 4.50	New York 4.75	
Cincinnati 4.35	Detroit 4.00		

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.55	3.20	3.00	3.00
Hot-rolled, No. 24*	2.20	3.55	3.25	3.50
Galvanized, No. 24	2.85	4.10	3.75	4.00

*Annealed

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches					
		¼	⅜	½	¾	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	5.95	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.55	3.50
Rivets	4.00	3.30	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except stove), nuts, and lag screws, mill lots 75%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn	5.75
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	2.90
Tin, Straits, pigs, spot, N. Y.	19.45
Zinc, slabs, E. St. Louis	2.60
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.25
Brass sheets, high	12.50
Brass tubing, high	15.75
Copper, drawn round	12.87½
Copper sheets	15.37½
Copper tubing	14.87½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	27.00
Babbitt, com'l, intermediate grade	32.75
Babbitt, genuine, highest grade	41.50
Solder, bar	15.75
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.00	1.75	1.50
Light brass	1.50	1.25	1.25
No. 1 rod-brass turnings	2.25	2.00	1.62½
Heavy copper	4.00	2.75	2.75
Light copper	3.25	2.50	2.37½

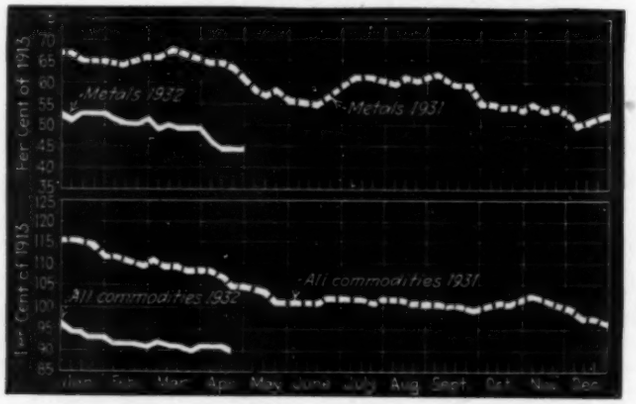
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40–5%	40–5%	40–5%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60–10%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.

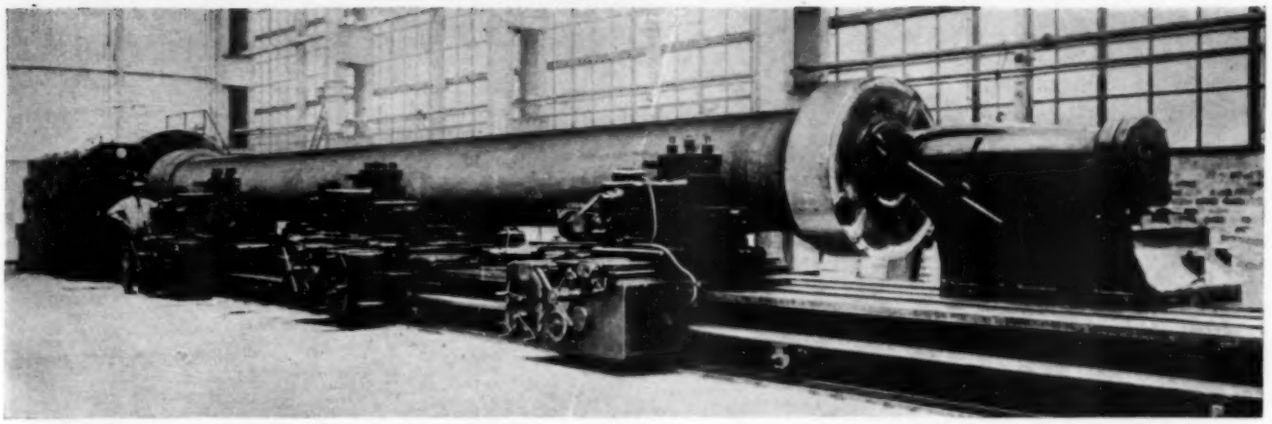
Crating — Southern pine:
1x4-in., sq. ed. $27.00 1x6-in. $24.00

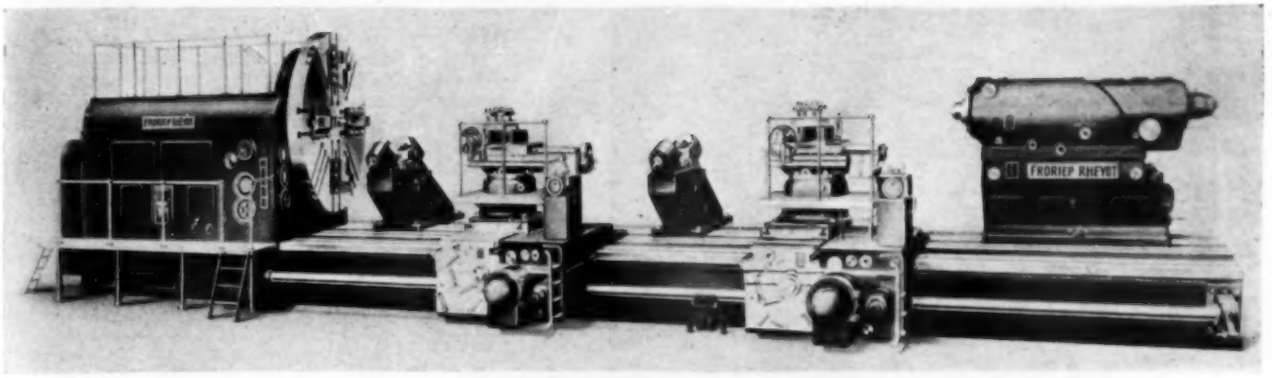
Skids — Spruce:
2x4-in. $35.00 3x4-in. $35.00 4x6-in. $37.00 6x6-in. $50.00

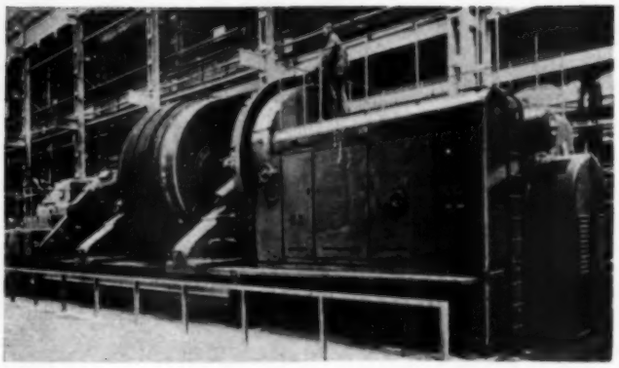

Per Cent of 1913
Metals 1932
Metals 1931
All commodities 1931
All commodities 1932
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist





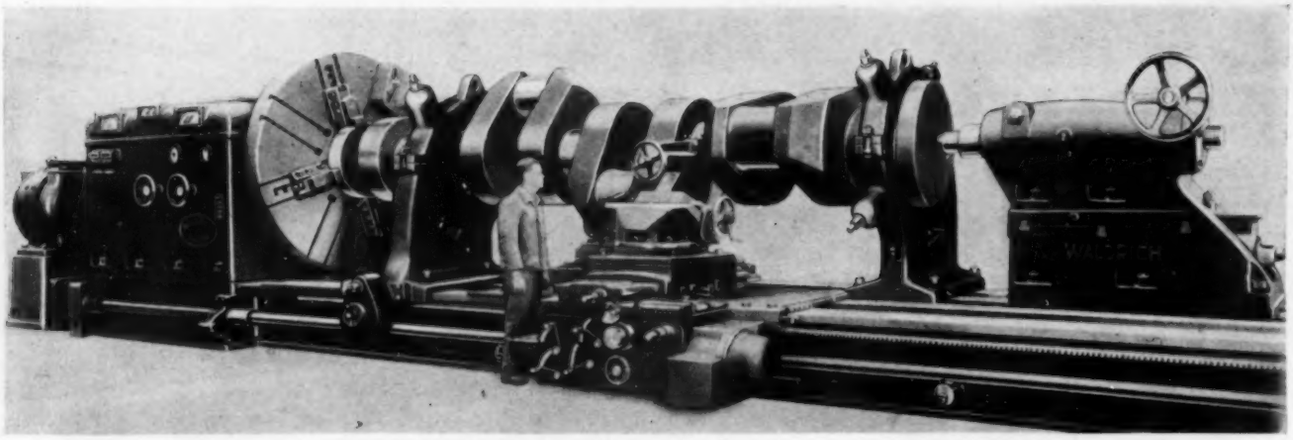


Top—Heavy-duty center lathe with 95-ft. bed and 350-hp. drive, capable of handling work 75 in. in diameter and 75 ft. long up to 100 tons between centers. Speeds are suitable for cutting with carbide. The six tools remove 0.77 sq.in., each tool cutting 0.155 sq.in. Shown by Schiess-Defries AG.

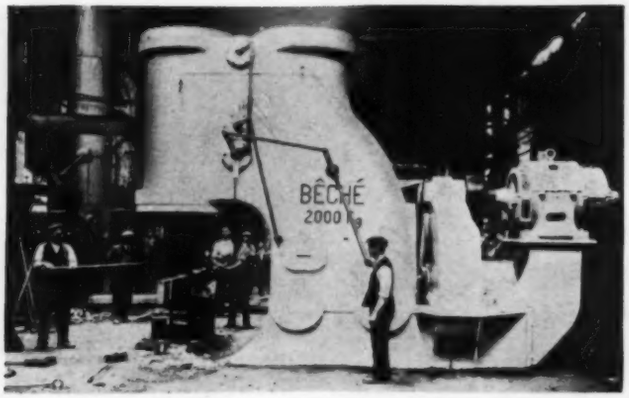
Another center lathe, capable of swinging pieces up to 11 ft. 10 in. in diameter and 40 ft. long and weighing up to 150 tons. It has two carriages and is almost entirely electric in operation. Gear shifts for headstock speed changes are made by push-button, and four lamps of different colors indicate variations in faceplate r.p.m. Rapid travel of the carriage is by an individual motor. An electric cutting speed meter is also provided. An individual motor moves the tailstock and clamps and unclamps it. This lathe is especially designed for accurate work. The illustration which shows a large rotor being turned provides a better conception of its size by comparison with the man standing above it. Shown by Maschinenfabrik Froriep, Rheydt.

Metal-Working Machines at The 1932 Leipzig Spring Fair

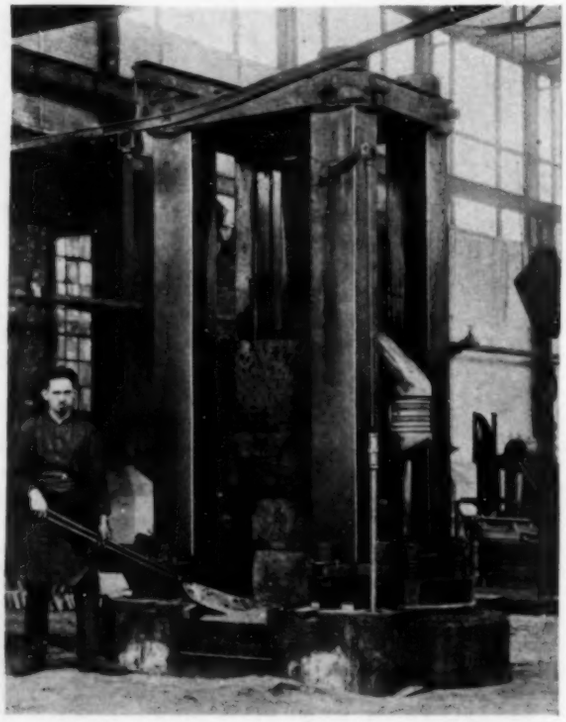
Third in the series of descriptions, the pictures on this and the next page show large lathes and pneumatic forging hammers



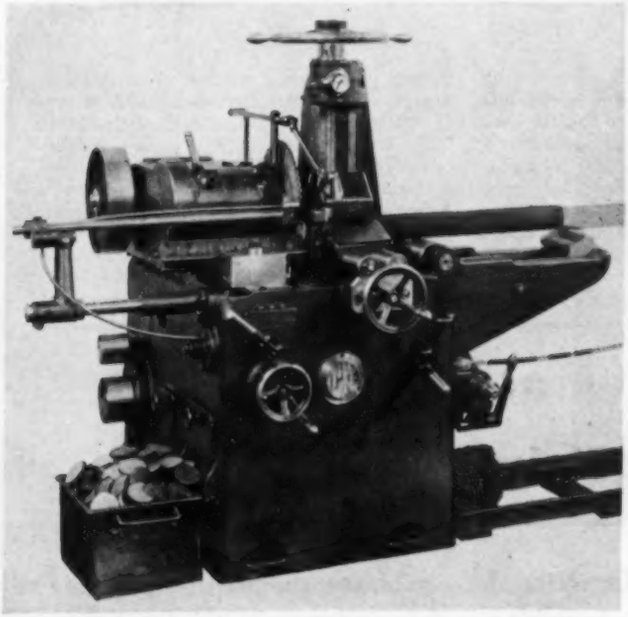
Above—A high-speed lathe designed for machining crankshafts and having special top slides on the front and rear carriages for turning bearings and cheeks with high-speed tools. The headstock is entirely inclosed. Removable cover plates on the carriage apron permit access to the gearing without taking the carriage off the bed. A small motor on the carriage provides rapid travel which may be engaged while the machine itself is not running. Shown by H. A. Waldrich, Siegen.



Above—Pneumatic power hammer with a 910-lb. tup. Pressure is provided by means of an electric motor operating a gear drive through a flexible coupling. The hollow tup is one piece of forged steel made without welding. Shown by Bêché and Grohs.



Right—A high-speed controlled tup drum hammer with a 2,400-lb. tup. It operates at 100 strokes per min. The effect of the blows is about 250,000 kg. per 100 kg. falling weight, equal to a drop of 100 in. of the tup. Shown by Bêché and Grohs.



Left — Automatic cold-sawing machine shown by Gustav Wagner, Reutlingen, oil-hydraulic fed and clamped. This unit is automatically controlled throughout for production cutting of similar sections. Work is unclamped, reset and cutting begun again after each cut is completed. Suitable elements provide rapid return for the horizontally traversed cutting head.

Metal-working Machinery Exports Off Six Per Cent from February

EXPORTS of power-driven metal-working machinery in March were off 6 per cent in value from the February figure and 26 per cent less than for the same month a year ago. A half million dollar increase in the February exports as compared with those of January was reported last month by the Bureau of Foreign and Domestic Commerce whose figures, detailed as to machine classifications, follow:

	March, 1931	March, 1932	Feb., 1932
Engine lathes	306,284	46,385	121,215
Turret lathes	101,807	7,491	22,848
Other lathes	138,429	11,474	119,155
Vertical boring mills and chucking machines	101,889	13,262	47,105
Thread-cutting and automatic screw machines	32,111	22,354	31,087
Knee and column type milling machines	88,301	13,279	18,864
Other milling machines	134,245	42,171	100,849
Gear-cutting machines	173,538	31,299	63,395
Vertical drilling machines	96,432	14,062	34,636
Radial drilling machines	23,883	.....	.....
Other drilling machines	96,809	46,079	11,281
Planers and shapers	103,333	16,425	61,421
Surface grinding machines	30,352	13,595	25,328
External cylindrical grinding machines	111,965	60,046	49,582
Internal grinding machines	75,448	4,735	46,005
Tool-grinding, cutter-grinding and universal grinding machines	80,891	18,256	67,746
Other metal grinding machines	139,539	46,663	37,125
Sheet and plate metal-working machinery	421,655	46,316	66,036
Forging machinery	293,396	110,093	151,719
Rolling-mill machinery	187,538	28,494	30,317
Foundry and moulding equipment	146,394	38,021	43,450
Other power driven metal-working machinery and parts	275,092	208,106	224,796

Classified under "other metal-working machinery" are the following items:

	March, 1931	March, 1932	Feb. 1932.
Pneumatic portable tools	142,397	49,662	42,624
Other portable and hand or foot operated metal-working machines and parts	62,422	44,386	33,135
Chucks for machine tools	14,428	3,167	3,949
Machine-operated pipe and thread cutters, stocks, dies, taps, and other machine-operated cutting tools	93,420	68,591	177,109
Other metal working machine tools	122,150	49,507	36,686

Exports in the machinery group during March were valued at $24,225,405. This is an increase of $2,255,000 over the total value of exports in February, but represents only half the volume of exports in March of 1931. The upturn over February is confined largely to electrical machinery and apparatus and to construction and conveying machinery. All of the major groups show a decline as compared with March of last year. The comparative figures, which are those of the Bureau of Foreign and Domestic Commerce, covering the major groups are as follows:

	March, 1931	Feb., 1932	March, 1932
Electrical machinery and apparatus	$7,451,529	$4,344,256	$4,654,495
Power generating machinery (except electrical and automotive)	1,122,923	751,541	422,498
Construction and conveying machinery	1,214,120	289,483	477,577
Mining, well and pumping machinery	2,135,764	1,009,425	940,523
Power driven metal-working machinery	3,159,331	1,273,960	838,606
Other metal-working machinery	434,817	293,503	215,313
Textile machinery	658,397	485,012	484,093
Sewing machines for domestic use	188,218	232,988	74,400
Sewing machines for industrial use	247,690	204,677	308,253
Other industrial machinery	3,859,289	1,656,498	1,622,525

Despite the decrease of exports in March, 1932, as compared with March of the preceding year, there are certain items which show increases. Some of them are: accessories and parts for generators; power transformers; switchboard panels, except telephones; radio receiving tubes; starting, lighting and ignition equipment; certain knitting machines; cotton spinning and twisting machines; refrigerating equipment over 10-tons capacity.

In exports of all merchandise the United States maintained its position as the world's leading exporter for the year 1931, according to a statement of R. A. LAMONT, Secretary of Commerce. Outgoing merchandise shipments for the year totaled $2,377,981,786, not including reexports. Germany displaced the United Kingdom in second rank with exports to the value of $2,192,850,000, including reparations in kind. Exports from the United Kingdom reached only $2,069,823,000, including reexports. France was fourth with $1,192,516,000.

Move to Recognize Russia Gains; Only Country Not Curtailing Imports

WITH Russian trade so desirable at this time and many business men and industrial leaders reminding Congress that Russia is the only foreign market that has not curtailed its imports, the movement for recognition of the Soviet government has lately been gaining strength. Whether for trade or political reasons Democratic leaders in Congress are beginning to devote increased attention to proposals for recognition. SENATOR ROBINSON of Arkansas, Democratic leader of the Senate, is one of the most recent converts. REPRESENTATIVE RAINEY of Illinois, majority leader of the House, also has endorsed the movement. Meanwhile REPRESENTATIVE FISH, New York Republican, has dared the Democrats to make an issue of Russian recognition.

Efforts are being made to obtain action on Senate and House bills requesting the Administration to commence negotiations looking to the resumption of normal diplomatic and trade relations with Russia. The Senate bill is sponsored by SENATOR BORAH, while the House bill was introduced by REPRESENTATIVE SABATH of Illinois. The House Foreign Relations Committee has indicated that it will hold hearings on the matter in the near future.

Despite the fact that Russia offers the finest export market, United States manufacturers have been handicapped in their efforts to take advantage of the opportunity because of unsatisfactory trade relations. Consequently, Russia has shifted most of its business to other countries. In the last two years American exports to the Soviet have declined nearly 95 per cent, while German exports to Russia over the same period have increased 107 per cent. Moreover, it is pointed out that Germany financed most of its Russian trade with money borrowed in the United States.

McKibben Chosen A.W.S. President

F. P. MCKIBBEN, consulting engineer of General Electric Co., has been elected president of the American Welding Society for the coming year and has also been named recipient of the 1931 Miller medal for outstanding achievement in fusion welding of structural steel. The Society held its annual meeting in the Engineering Societies Bldg., New York City, April 27-29.

A. E. GAYNOR, of John A. Roebling's Sons Co., has been elected senior vice-president. Newly elected divisional vice-presidents include: H. N. EWERTZ, welding engineer, Austin Hastings Co.; A. F. DAVIS, vice-president, Lincoln Electric Co., and H. S. CARD, editor of *The Welding Engineer*.

Directors at large were chosen as follows: C. A. ADAMS, Harvard University; H. M. HOBART, General Electric Co.; D. S. JACOBUS, Babcock & Wilcox Co.; and J. W. OWENS, consulting engineer. M. M. KELLY was elected secretary and C. A. MCCUNE treasurer.

At the meeting of the board of directors the following committee chairmen were appointed: F. P. MCKIBBEN, exec-

utive; C. A. McCune, finance; J. B. Tinnon, meetings and papers; A. E. Gaynor, membership; and A. M. Candy, revision of by-laws.

Topics of Papers

Included in the papers presented at the meeting were those on welding applied to shipbuilding; experimental verification of theoretical methods of calculating stress in fillet welds; methods of constructing welded barges; a study of the transformation points of fusion weld metal; cause and cure of intergranular corrosion in austenitic steels; Linde-welding; welding wrought iron pipe; spot welding; production welding of light-gage metal specialties; welding of extruded metal; modern spot and relief or projection welders; machine gas welding; pipe welding for a high-pressure steam power plant; new aspects in pipe welding; and a symposium on ductility in welds.

The 11th Annual Dinner was held in the evening of April 28, and the meetings of the Structural Steel Welding Committee and American Bureau of Welding on the afternoon of the last day of the meeting.

Railroads Accept Coupler Changes

Two recommendations pertaining to automatic couplers originated by the mechanical division, American Railway Association, have been approved by railroads of the country and are expected to result in substantial financial savings to the carriers. One recommendation approved provides for a change in the contour and dimension of automatic couplers on both freight and passenger cars. This change, the railroads estimate, will extend the life of those couplers at least four to five years. The other recommendation provides for uniformity on all railroads of welding processes for the reclamation of used automatic couplers and parts.

Farms for 4,500 Harvester Employes

Four thousand five hundred former Chicago employees of International Harvester Co. are to be given plots of ground to cultivate as gardens this spring and summer according to a recent announcement of the company. Tractors have begun to prepare more than 1,000 tillable acres leased by the company for the unemployed forces, each individual to have one quarter of an acre for his own use. Seeds and cultivating tools are to be furnished by the company. Similar programs may be adopted at other plants of the company in Fort Wayne, Ind., Milwaukee, Canton, Ill., and Auburn, N. Y.

French Home Industries Slow

Germany Leads at Utrecht Fair

POSSIBLY as a result of the new high tariff and import quotas as well as of the new super-tax on importation of raw material, semi-finished and finished products, the number of unemployed seeking assistance in France has fallen 2,278. According to official figures, the number of unemployed now stands at 303,218, of which 153,000 are in the Paris region alone and 32,670 are from the metal-working industries. Despite this fact, four- and even three-day working weeks are being applied in many plants in the Paris district where the activity is usually the greatest. In the Lyons district 490,000,000 francs in wages were paid in the metal trades in 1930 and but 390,000,000 francs in 1931. Electrical equipment output fell off 35 per cent; the foundry industry, 27 per cent; machinery output, 25 per cent; automobile industry, 22 per cent.

Comment in machine tool manufacturing circles is to the effect that trade with Japan has fallen off in favor of the United States and Germany because of better trade equipment of the former and lower freight rates of the latter, indicating cooperation in German industry to an extent not known in France. Makers of agricultural machinery have formed a consortium for handling the export trade of their products. The Renault firm is one of the leaders of this group.

Shipbuilding has been under a cloud for months. The French Mechanical Industries Association has formed an affiliated organization, virtually a cooperative, for the purchase of raw materials, machinery, tools, and supplies, with a view to reducing costs.

The new super-tax of 4 per cent on semi-finished and 6 per cent on finished products vitally affects machine tool and parts imports. Classified among the semi-finished are: replacement parts in the rough, flywheels, axles, boilers, dynamo frames, steel rolls, cylinders, blanks, unfinished gears, etc. Finished products include: all finished manufactures of metal, jewelry, watch cases, finished replacement parts of machinery, automobiles and tractors and their parts, prime movers and motors for sea, land and air application, typewriters, machinery, machine tools and similar articles. The new tax takes no account of the time of placing orders, even under contract for partial delivery at intervals, but only of the shipping date.

Exhibitors at Utrecht Fair

Berlin—Germany occupied the first place among the foreign exhibitors at the recently terminated Utrecht Fair (Holland) with a total of 220 firms exhibiting. France had 109 firms represented; England, 57; Austria, 32; Belgium, 23; and the United States, 21. Holland, home of the Fair, had 1,078 firms represented.

The German industry has recognized the necessity of presenting its products to the Dutch market, as well as to those of the Dutch colonies, at the Utrecht Fair. A large number of Rotterdam buyers, who contract for colonial requirements, were present at the Fair.

This year, for the first time, the exhibits were divided according to industrial branches as follows: Machines, tools and metal goods; electrical and radio products; contractor's machinery, especially for road construction; transportation equipment; furniture; textiles; chemical and pharmaceutical products; earthenware, china and cut glass; jewelry and fancy goods; paper goods and office requisites (including machines); wrapping and advertising requisites; foodstuffs, confectionery, etc. (including machines).

The Utrecht Fair furnished evidence of the tendency in most European countries to regulate the sale and purchase of their products and requirements at their own fairs or exhibitions. Although the Leipzig Fair is still important, it was observed that many large deals not only in small industrial or agricultural products, but also in machines, were closed at the national fairs of the various other countries.

German Exports Fall

German exports of coal, iron, potash, paper, dyes, porcelain and glass showed a decline for the month of March, but export of chemicals was maintained and some sorts of machines were shipped out in larger quantity. Foreign orders for the first half of April were reported also to have decreased. Manufacturers in South Germany have been exporting at prices 30 per cent below those of a year ago and at a heavy loss. Despite this fact, there is a fair prospect that favorable trade balance will be maintained in consequence of reduction of imports. In March the import of fully manufactured goods was less than $4,000,000.

Sand Blast Clinic

The Wesley Steel Treating Co., Milwaukee, Wis., is offering to provide its customers a free clinic on sand-blasting problems. To those who apply before May 10 the company agrees to provide: A list of possible applications of sand blasting for stated manufacturing problems; an analysis of possible savings in cost of cleaning and other processes; technical suggestions, such as methods of checking for flaws, methods of improving the product, methods of speeding up finishing processes such as enameling, japanning, buffing and painting, and an explanation of the application of sand blasting to glass, brass and other products, in addition to steel.

THE BUSINESS WEEK

May 4, 1932

We have reached the stage of our difficulties where we cannot afford to be ungrateful for small favors . . . Despite the doubts and discouragements about certain fundamental features of the situation, particularly as regards official and legislative attitudes toward the problem of recovery, April afforded some evidence of inherent economic vitality and convalescence . . . The decline in important business indicators and in commodity prices slackened and in some cases ceased . . . Merchandise carloadings have risen moderately, and as the month closes steel production is slowly expanding under the stimulus of increased activity in the automobile industry, which is expected to continue for several months . . . More significant are the first signs that Federal Reserve efforts to start credit expansion are beginning to take effect . . . Although contraction continued in the out-of-town banks, loans and investments of the New York member banks last week showed an important and unexpectedly prompt response to open-market operations of the Reserve authorities for the first time since last September, including even an upturn in commercial loans . . . Reduction of money rates in foreign centers also reflects further easing of financial tension . . . If this tendency continues it will be an encouraging indication that the stormy winter is past and spring not far behind . . . At this jittery juncture it would be most helpful if Congress could put aside its stock-market muck-rake and begin to do some spring plowing for the crop of constructive measures that will be much needed before the harvest moon, no matter who is elected.

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• BUSINESS ITEMS •

Coburn Trolley Track Mfg. Co., Holyoke, Mass., on a petition from Republic Steel Co. and others, has been placed in receivership. HARLAN I. DENNETT, Holyoke, Mass., and FREDERICK M. KINGSBURY, Longmeadow, Mass., have been appointed receivers. They will take charge of the plant and operate it. The concern manufactures fireproof doors and other products and employs up to 200 persons.

Yates American Machine Co. has leased quarters at 2726 First Ave. South, Seattle, Wash., where it will maintain a Pacific northwest branch and district headquarters. The office at Portland, Ore., formerly district headquarters, will be continued.

Gears & Forgings, Inc., Cleveland, Ohio, announces that although in the hands of receivers, it is operating as usual. Rumors to the effect that operations had been discontinued have no foundation. Work is being carried forward in the usual manner by the same workmen as heretofore, pending a reorganization of the company's financial structure.

Bullock Manufacturing Associates, Springfield, Mass., has made an assignment to EVERETT H. CLARK for the benefit of its creditors. Mr. Clark will have the property appraised with a view to selling it. The plant, now closed, was built new two years ago. The company, which specializes in small tools for printers, jewelers, carpenters and mechanics, was established in 1873.

Airtherm Mfg. Co., St. Louis, R. J. TENKOHONY, president, has been organized to succeed the Skinner Bros. Mfg. Co. in production of heater units, ventilating machinery, drying equipment and conveying machinery.

Locomobile plant at Bridgeport, Conn., has been taken over by Liberty Building Corp., and B.P.C. Corp., Bridgeport, through negotiations with Locomobile Bondholders' Protective Committee. The plant will be leased to a number of small companies.

Parker & Harper Mfg. Co., Worcester, Mass., has been licensed by Dardelet Threadlock Corp. to manufacture and sell screw machine products with Dardelet self-locking thread.

Remington Arms - Union Metallic Cartridge Co., Bridgeport, Conn., plans to move part of its New York office to Bridgeport. An executive office will still be maintained at 25 Broadway, New York, but the president's office will be in Bridgeport and a large part of the sales force will work out of that city.

American Manganese Bronze Co., Holmesburg, Philadelphia, Pa., has purchased the good will, equipment and all assets except real estate of Paul S. Reeves & Co. and of the Caskey Brass & Bronze Co., both of Philadelphia. The entire business of the three companies is being handled at the Holmesburg plant. SAMUEL K. REEVES, president of the Reeves Co., becomes a director and vice-president of American Manganese Bronze. FRANK E. SHIPLEY, president of the Caskey Company, has also become identified with the American Manganese Bronze Company. THOMAS H. ADDIE remains president of American-Manganese.

Plants of Western Machine Works, Tacoma Brass & Pattern Co., Tacoma Industrial Supply Co. and Western Welding Works were partially damaged by a fire which recently destroyed the woodworking plant of Puget Sound Mfg. Co., Tacoma, Wash.

Combustioneer, Inc., manufacturer of automatic coal stokers, is moving its plant from Goshen, Ind., to Springfield, Ohio. Its products will be manufactured by Steel Products Engineering Co.

Indianapolis Castings Co., 131 South Harding St., Indianapolis, has filed a voluntary petition in bankruptcy listing total liabilities at $44,178.55 and estimated assets at $40,000, the latter mostly machinery and building. The book value of the plant is $128,275, and the machinery book value, $158,020.29. Union Trust Co., Indianapolis, has been made receiver.

The Pioneer Engineering and Manufacturing Co., Detroit, Mich., manufacturer and distributor of coolant and lubricant pumps, multiple-spindle drill heads, and electro-chemical copper patterns has announced the signing of exclusive sales agency contracts with Banner Machine Tool & Supply Co., St. Louis, Mo.; Machinery Sales & Engineering Co., Indianapolis, Ind.; and Walter J. Whatley, Syracuse, N. Y.

Golden-Anderson Valve Co., plant at Monessen, Pa., was damaged April 22 by fire. The loss was more than $35,000.

McConnell Bronze Casting Co., recently organized, has started operations at 2950 Penn Ave., Pittsburgh, occupying the plant of the former Hill-Wallisch Bronze Co. E. E. MCCONNELL is president and A. G. MERCER, secretary-treasurer.

Electric Furnace Co., Salem, Ohio, has purchased the business of Process Engineering & Equipment Corp., Attleboro, Mass., builder of bright annealing and controlled atmosphere furnaces. All equipment of the Process corporation has been moved to Salem.

Dissolution of Economy Machinery Corp., Indianapolis, Ind., is sought in papers filed by officials of the company with the Secretary of State of Indiana.

Martin Aircraft & Engine Corp., Delaware, Ohio, has been organized by WESLEY C. MARTIN, New Carlisle, Ohio, and C. N. DASE, Springfield, Ohio, for the manufacture of automotive engines and aircraft. ALLEN RUTHERFORD is the local representative.

John E. Livingstone Co., 2-246 General Motors Bldg., Detroit, Mich., has been appointed sales agents for Hoist & Crane Division of Robbins & Myers, Inc., Springfield, Ohio, covering the Detroit territory.

R.R. Shop Waste Topic at Detroit

C. B. HALL, Stores manager, Pennsylvania Railroad, Philadelphia, Pa., in a paper on "Common Savings in Shop Waste," presented before the Management and Materials Handling Divisions of the American Society of Mechanical Engineers at the M-M-M Congress in Detroit, May 4-5, told of economies that had been effected in the handling of scrap and in reclamation of work materials by the Pennsylvania.

Mr. Hall also pointed out in his paper that in periods of good earnings the railroad currently writes off the value of obsolete materials, but is not always in position to carry out this policy because the loss must be charged to expenses sometimes when the operating expenses are not in condition to take it. He recommended the policy of holding bargain sales as a means of getting some real money out of what can be disposed of and thereby avoiding the carrying charges on investment.

• PERSONALS •

DR. AMBROSE SWASEY is to receive the Franklyn Medal of the Franklyn Institute, Philadelphia, May 18.

C. E. ALLEN, commercial vice-president of the Westinghouse Electric & Mfg. Co., has recently been elected a vice-president of American Management Association for the term 1932-1933. He will be in charge of the consumer marketing division.

CHARLES S. BELSTERLING has been appointed vice-president of United States Steel Corp. in charge of traffic, and R. E. ZIMMERMAN has been appointed assistant to the new president, W. A. IRVIN.

GEORGE BICKFORD, formerly with Henry Prentiss Co. and previous to that with Jones & Lamson Machine Co., has joined the staff of Triplex Machine Tool Co., as New England representative.

A. O. BREDEMERE is terminating his duties as manager of the Detroit office, National Acme Co., Cleveland, Ohio.

DONALD L. BROWN, president, Pratt & Whitney Aircraft Co., Hartford, Conn., and EUGENE E. WILSON, president, Chance Vought Corp., Hartford, Conn., have been elected directors of United Aircraft and Transport Corp. Both Pratt & Whitney and Chance Vought are subsidiaries of United.

LEWIS E. BROWN, Battle Creek, Mich., has been elected general manager of International-Stacy Corp., 875 Michigan Ave., Columbus, Ohio. Mr. Brown will relieve HARRY N. RUNKLE, president, of some of his duties.

T. R. DAHL and GEORGE H. KELLY have been elected directors of White Motor Co. Mr. Dahl is vice-president and secretary and Mr. Kelly is a vice-president.

A. A. Dicke, patent attorney for Remington Arms Co., Inc., 25 Broadway, New York, N. Y., has resigned to take up the general practice of patent law, particularly engineering patents.

NICHOLAS DREYSTADT has been appointed works manager of Cadillac Motor Car Co., succeeding A. U. WIDMAN, resigned.

W. F. DRYSDALE, M.I.E.C., has been named vice-president of Montreal Locomotive Works. He was formerly mechanical engineer of North Railway of Costa Rica.

J. H. FITCH, JR., Detroit, vice-president, treasurer and director, Newton Steel Co., has resigned.

JOHN E. LYNCH and JOSEPH P. BALDEZ have been appointed sales engineers in the Cincinnati direct sales office of Cincinnati Milling Machine and Cincinnati Grinders, Inc. The territory covered by this office includes Cincinnati, Dayton, Springfield, Columbus, Troy and Piqua, Ohio; Louisville, Kentucky; Huntington and Charleston, West Virginia.

ALLAN J. MOGENSEN, *Factory and Industrial Management*, spoke on the "Effect of Motion Study on Plant Layout" at a meeting of the Management Division, Metropolitan Section, A.S.M.E., May 4, in the Engineering Societies Building, 29 West 39th St., New York, N. Y.

HENRY NIAS, W. C. BESCHORMAN, FRANKLIN CONKLIN, JR., and M. D. HOWELL were elected directors of Doehler Die Casting Co. P. V. SHIELDS and L. H. MORIN have resigned.

G. E. PASSAGE, division master mechanic, Terre Haute division, Chicago, Milwaukee, St. Paul & Pacific Railroad, has been transferred to a similar position at Aberdeen, S. D.

M. RACHWALSKY, of George Stenzel & Co., Berlin, has returned to Germany after a month's visit to the United States.

W. J. RAY, former district manager, Toledo Scale Co., Peoria, Ill., has been appointed to similar duties at Buffalo.

DUDLEY H. SMITH, 221 East 20th St., Chicago, Ill., has been added to the staff of Geometric Stamping Co., Cleveland, Ohio.

R. C. STEESE has been elected a director of Youngstown Sheet and Tube Co., succeeding the late RICHARD GARLICK. WALTER MENT also was elected a director to fill a vacancy, and a resolution was passed reducing the number of directors from twelve to eleven.

ROBERT J. WALKER, formerly vice-president, has been made general manager of Bradley & Hubbard Mfg. Co., Meriden, Conn., succeeding the late Charles F. Linsler. FRANK S. HUBBARD, factory manager, has been elected secretary.

JOHN N. WILLYS, Ambassador to Poland, and chairman of the board, Willys Overland Co., has resigned from his Ambassadorship in order to give more time to his business interests.

• OBITUARIES •

PETER BOYD, 83, retired official of National Tube Co., Pittsburgh, Pa., died recently at his home in Beaver, Pa.

DAVID J. GRANGER, partner in the Sterling Drop Forge Works, Cicero, Chicago, Ill., died April 15.

STANTON A. GUEST, 53, owner of Guest Machine Shop, Huntington, Ind., died recently at his home following two heart attacks.

CLIFFORD L. KEITH, 59, owner, Keith Furnace Co., died at Cincinnati April 22.

JOSEPH A. KELLY, 75, founder and until recently president of Reliance Steel Casting Co., Pittsburgh, died in that city recently.

G. A. E. KOHLER, 68, engineer, inventor and manufacturer, died April 29 in Chicago, Ill. He was sole proprietor of Kohler Brothers, electrical engineers, Chicago and New York, and chairman of the board of Kohler Aviation Corp. He was also intentor and manufacturer of Kohler system for printing presses.

JOHN A. MCRAE, 77, pioneer industrial leader and president of Coast Iron & Machine Works, died at his home in Tacoma, Wash., April 24.

LOUIS MERTENS, 77, founder of Keystone Brass Co., Erie, Pa., died recently at his home in that city following illness of a week.

ROBERT MIEHLE, 72, inventor of printing presses and appliances, died recently in Chicago. His early inventions formed the basis for organizing the present Miehle Printing Press & Mfg. Co., Chicago. Mr. Miehle had been connected with the company until 1914, since when he had been associated only in a consulting capacity.

SYLVANIS SNYDER MITTS, 86, former president of Mitts & Merrill, Saginaw, Mich., died recently at his home in that city. Mr. Mitts had been active until a few days before his death. He founded the firm of Mitts & Merrill in 1875 in partnership with WILLIAM MERRILL. In 1903, the company was incorporated with Mr. Mitts as president. He retired in 1929.

WILLIAM J. POWERS, sales engineer of Swind Machinery Co., Philadelphia, Pa., died April 25, after a long illness. Mr. Powers had been with the Swind company for 19 years.

NATHAN S. SHERMAN, 71, founder of Sherman Machine & Iron Works, Oklahoma City, Okla., died recently at his home in Seattle, Wash. Mr. Sherman retired seven years ago after turning over his business to his sons, N. W., W. S. and E. W. SHERMAN.

Specification for Aluminum Revised

Proposed revision of F.S. No. QQ-A-451 on aluminum has been sent, out by the Federal Coordinating Service, Federal Specifications Board, Washington, D. C. The specification covers grades, material and workmanship, packaging, packing and marking, and other information on aluminum ingots, sheet aluminum, aluminum powder for paints, and varnish mixing for aluminum paint. DR. GEORGE K. BURGESS, chairman, requests that those who have suggestions to make concerning these specifications communicate with him.

Iron Change Pictured

A motion picture showing microscopically the passage of iron through its critical temperature range was exhibited at a meeting of the Philadelphia chapter, American Society for Steel Treatment April 29. DR. VICTOR HOMERBERG, Massachusetts Institute of Technology, and Nitralloy Corp., addressed the meeting on the subject of nitriding.

Would Eliminate Excess Capacity

Excess capacity of all sorts is littering up the road of industrial progress to a serious degree, J. P. JORDAN, of Stevenson, Jordan & Harrison, stated in an address before the Financial Division of the American Management Association, at the Hotel Pennsylvania, New York City, May 4. "Excess capacity not only exists in practically every industry at the present time but it existed prior to this depression," Mr. Jordan said. "There probably is no industry in which the peak capacity is not from 25 to 100% above the highest peak production ever known."

"There are two types of companies which menace any particular industry," Mr. Jordan continued. "First, the company in which production capacity is obsolete or nearly obsolete, and second, the company in which even fairly up-to-date plant capacity is in such excess that the net result of a year's business spells loss."

"Only one procedure is logical to absorb, regulate or scrap such excess capacity, i.e., the action of the industry as a whole," Mr. Jordan said. The hands of business, however, are tied through our anti-trust laws, he declared. These laws must be modified and business be given the right to organize and control its own operations.

A complete program would, according to Mr. Jordan, include: first, the elimination of excessive capacity that is a constant menace to the successful and normally profitable operation of each industry; and second, the power so to regulate the conduct of the industry that it may be continually safeguarded.

"We must change our laws regulating business, so that each industry will be given the right to form a firm organization and to govern and control itself," Mr. Jordan declared. "This organization of the industry must carry with it compulsory membership on the part of every firm engaged in the industry and must give control to a majority. New capital desiring to engage in an industry in which the capacity is in excess of production schedules must first secure a certificate of convenience and necessity."

"There is no reason why industry cannot actively ask for and insist strenuously upon an amendment of existing laws that will, at least, permit an accredited organization of companies to scrap such a portion of the existing capacity as would remove the menace which now exists and thereby stabilize the industry."

In concluding, Mr. Jordan suggested that some powerful industry take deliberate action on the matter of acquiring and scrapping excess capacity and thus bring the whole question into wide and healthy publicity.

N. M. T. A. PRESIDENT

Jacob D. Cox, Jr., president of the Cleveland Twist Drill Co. succeeds J. B. Benedict as head of National Metal Trades Association

Industrial Relations Course at Princeton

Unemployment benefits, employment stabilization, dismissal compensation, pensions and insurance, and group relations will be among the subjects for consideration at a conference course on "Problems in Industrial Relations" to be held under the auspices of Princeton University, Sept. 19-24. This will be the second conference of this character to be sponsored by Princeton University.

Included among the tentative speakers are EDWARD S. COWDRICK, industrial engineer, New York; and MORRIS E. LEEDS, president of Leeds & Northrup Co., Philadelphia; J. M. LARKIN, assistant to the president of Bethlehem Steel Co., Bethlehem, Pa.; WHITING WILLIAMS, industrial engineer, Cleveland; and JOSEPH H. WILLITS, professor of industrial management, University of Pennsylvania, Philadelphia, and other experienced men.

Foundrymen's Assn. Nominates Officers

Nominations for officers of Pittsburgh Foundrymen's Association for the year 1932-33 have been announced as follows: T. A. REYNOLDS, McConway & Torley Co., Pittsburgh, president; G. H. ZOERB, Sharpsburg Foundry Co., Sharpsburg, Pa., vice-president.

Nominees for the executive committee of the association are: F. C. T. DANIELS, Mackintosh-Hemphill Co., Pittsburgh; C. E. DAVIS, Homestead Valve Mfg. Co., Coraopolis, Pa.; S. B. CUTHBERT, Carnegie Steel Co., Braddock, Pa.; and H. P. SPILKER, Sterrit-Thomas Foundry Co., Pittsburgh. Election of officers will be held at a coming meeting. ARTHUR J. TUSCANY, Gray Iron Institute, Inc., Cleveland, will address the association at its regular monthly gathering May 16.

• MEETINGS •

AMERICAN GEAR MANUFACTURERS ASS'N
Sixteenth Annual Meeting, Hotel Statler, Cleveland, Ohio, May 12-13. Executive Committee meeting, same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

CHAMBER OF COMMERCE OF UNITED STATES
Annual meeting, Palace Hotel, San Francisco, May 17-20. D. A. Skinner, 1615 H St. N.W., Washington, D. C., secretary.

AMERICAN IRON AND STEEL INSTITUTE
Forty-first general meeting, Hotel Commodore, New York City, May 19. Howard H. Cook, secretary, 350 Fifth Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
1932 summer meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 12-17. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eiseman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Colo., Pueblo—Flash Service Inc., c/o Colorado Realty Co., 321 North Santa Fe Ave., will soon start work on a 125 x 226 ft. service station at Santa Fe Ave. between 5th and 6th Sts. Estimated cost $125,000.

D. C., Washington—Constructing Quartermaster, War Department, will receive bids until May 24 for construction and completion of four buildings, including air corps warehouse, maintenance building, etc., at Bolling field.

D. C., Washington—Department of Interior, will receive bids until May 31 for hospital improvements including removing, relocating and remodeling shops, etc. Estimated total cost $1,050,000.

Ind., Lafayette—Minardo Bros., awarded contract for construction of a 1 story, 120 x 135 ft. plant at Chestnut St. and Nickel Plate R.R. Estimated cost $40,000.

Mass., Leominster—Fitchburg-Leominster Airport Corp., 84 Prospect St., plans construction of an airport including hangars, shops and reconditioning facilities. Estimated cost $65,000. G. Hadden, 607 5th Ave., New York, Archt. and Engr. Maturity indefinite. Noted April 21.

Mass., Waltham—Woodward & Tyler, 644 Main St., awarded contract for construction of a 1 story, 35 x 115 ft. service station at Main and Bank Sts. Estimated cost $50,000. Goodyear Tire & Rubber Co., 1144 South Market St., Akron, O., lessee. Noted March 10.

Mass., Worcester—Colonial Beacon Oil Co., 30 Beacham St., Everett, awarded contract for construction of an oil terminal building including garage, office, tanks, etc. Estimated cost $45,000. Noted April 21.

Minn., Minneapolis—General Electric Realty Co., 120 Broadway, New York, N. Y., completing plans for construction of a 210 x 220 ft. service building, shop and office including shop equipment at Washington Ave. S and Second St. here. Estimated cost $500,000. Private plans. General Electric Co., River Road, Schenectady, N. Y., lessee.

N. J., Elizabeth—Elizabeth Lumber Co., c/o M. Goldberg, 1057 East Grand St., plans completed for a 2 story factory. Estimated cost $40,000. Joseph Anderson, 251 North Broad St., Archt.

N. J., Freehold—Standard Oil Co. of New Jersey, C. W. Crowell, 185 Washington St., Newark, awarded contract for construction of a 1-story automobile service station at East Main and Spring Sts. here. Estimated cost $40,000.

N. J., Irvington—Thomas L. Lee, Inc., 495 Lyons Ave., manufacturers of plumbing supplies, completed plans for 2 story, 50 x 200 ft. factory, shop, etc. Estimated cost $40,000. N. J. Convery, 32 Walnut St., Newark, Archt. Maturity about December.

N. J., Montclair—Globe Realty Co., 790 Broad St., Newark, having plans prepared for construction of a 1-story automobile service station at Bloomfield Ave. and Valley Road here. Estimated cost $40,000. F. P. Friedman, 9 Clinton St., Newark, Archt.

N. J., Montclair—Kaveny Bros. Inc., 32 Valley Road, awarded contract for construction of an automobile laundry plant and service station at 310-312 Bloomfield Ave. Estimated cost $40,000. Lackawanna Terminal Garages, Inc., E. Wilkinson, Mgr., 310 Bloomfield Ave., lessee.

N. J., Newark—Alling Corp., 33 Ward St., revised plans completed for construction of a 1 story garage at 36-42 Columbia St. Estimated cost $42,000. W. E. Lehman, 972 Broad St., Archt. U. S. Post Office Department, Washington, D. C., lessee.

N. J., Newark—International Excavating Co., 537 Raymond Blvd., rejected bids for 1 story garage and office at Lister Ave. and Esther St. Estimated cost $150,000. G. E. Jones, 24 Commerce St., Archt.

N. J., Newark—Owner, c/o Alfred Peter, 207 Market St., Archt., having preliminary plans prepared for construction of a 2 story garage at Avon Ave. Estimated cost $40,000.

N. J., North Bergen—McDermott & Binda, 582 Bergenline Ave., Union City, Archts., completed preliminary plans for construction of a 1 story shop building at Bergen Pike and Van Wagenen St. here. Estimated cost $40,000. Owners name withheld. Noted April 7.

N. J., Paterson—John S. Royle & Sons (machinists), c/o Lee & Hewitt, 152 Market St., Archts. having revised preliminary plans prepared for construction of a 2 story factory on Straight St. Estimated cost $75,000.

N. J., Westfield—Charles J. Angelo, 509 Central Ave., plans to rebuild 2 story garage at 218 West North Ave. destroyed by fire. Estimated cost $40,000. Architect not selected.

N. Y., Brooklyn—Bee Line Realty Corp., H. B. Carter, Pres., Nassau St., Rockville Center, Long Island, will receive bids after May 15 for a 2 story, 45 x 55 ft. bus terminal, garage, etc., at Albee Sq. and Fleet St. H. R. Harvie, 370 7th Ave., New York, Archt. Noted April 21.

N. Y., Brooklyn—J. A. Boyle, 367 Fulton St., Archt., will receive bids about May 15 for construction of a 35 x 68 ft. service garage for M. & R. Du Britz, Empire Blvd. and New York Ave. Noted April 21.

N. Y., Brooklyn—Ramlo Realty Corp., W. Volman, Pres., 222 Eagle St., will build a 1 story, 50 x 100 ft. service garage at India and Oakland Sts. J. A. Napoli, 369 Fulton St., Archt. Work will be done by day labor. Noted April 21.

N. Y., Brooklyn—Todd Dry Dock Engineering & Repair Co., 23rd St., plans alterations and improvements to dry dock and shipbuilding plant. Estimated cost $40,000. Work will be done by day labor and separate contracts. Maturity soon. Noted April 7.

N. Y., New York—Magdelena Augolotti, 3829 Harper Ave., will receive bids late summer for construction of a 1 story, 40 x 46 ft. service garage at Boston Road and Heath Ave. Private plans. Noted April 14.

N. Y., New York—Two Streets Corp., A. O. Englander, Pres., 295 Madison Ave., will receive bids after May 9 for converting studio and office building into service garage, 3 story 66 x 197 ft. at 146 East 25th St. Estimated cost $40,000. J. Harrison, 220 East 42nd St., Archt.

N. C., Concord—Stonewall Jackson Training & Industrial School, awarded general contract for construction of a 3 story, 35 x 88 ft. school. $13,786. Noted April 21.

O., Columbus—Department of Public Works, T. S. Brindle, Supt., Ohio-Hartman Bldg., awarded contract for construction of a 4 story, 100 x 130 ft. addition to engineering experimental station at Ohio State University, for use of Highway Department. Estimated cost $100,000. Noted March 3.

O., West Carrollton—West Carrollton Parchment Co., awarded contract for addition and extensions to paper mill. Estimated cost $40,000.

Pa., Beaver Falls—Enterprise Machine Shop, Seventh St. and Eighth Ave., awarded contract for a 1 story, 40 x 90 ft. machine shop at Seventh St. and 8th Ave.

Pa., Grove City—Wendell August Forge Co., E. J. Fithian, Pres., will build aluminum forging plant here. Estimated cost $40,000 including equipment. Work will be done by owner's forces.

Pa., Philadelphia—International Business Machines Corp., 270 Broadway, New York, N. Y., leased building and plans alterations and equipment for branch assembly, storage and service building here. Estimated cost $40,000.

Tenn., Memphis—Dixie Greyhound Bus Lines, F. Smith, Pres., 146 Union Ave., will receive bids until May 9 for construction of a 1 story garage and maintenance building including motor, blacksmith and body shops, lubrication department, paint department, brake pits, etc. at High St. and Adams and Washington Aves. Estimated cost $125,000. Jones, Furbringer & Jones, Porter Bldg., Archts.

Tenn., Memphis — Sears, Roebuck & Co., North Parkway and Watkins St., will soon receive bids for construction of a 130 x 130 ft. service station in connection with retail and mail order plant at Autumn and North Cleveland Aves. Private plans.

Tex., Dallas—Southwest Terminal Inc., awarded contract for construction of a 1 and 2 story, 72 x 550 ft. motor freight terminal building at 700 South Lamar St. Estimated cost $110,000.

Wash., Bellingham—Consolidated Furniture Mfg. Co., A. R. DeBurgh, Pres., will build a 1 story furniture factory at Squalicum Creek waterway. Estimated cost $75,000. Work will be done by owners forces.

Ont., Alfred—Christian Bros., 984 Cote St., Montreal, Que., awarded contract for construction of an industrial school. Estimated cost $200,000.

Ont., Toronto — Frigidaire Corp., Third National Bldg., Dayton, O., plans establishment of a plant here. W. G. Wright, Toronto, Manager.

Que., Lachine—Jenkins Bros. Co. Ltd., 617 St. Remi St., Montreal (valves and packing) plans construction of a machine shop here. Estimated cost to exceed $40,000. Ross & MacDonald, 1 Belmont St., Montreal, Archts.

United Soviet Socialist Russia—c/o Amtorg Trading Corp., 261 5th Ave., New York, N. Y., will build an instrument manufacturing plant including finishing department, workers dwellings, etc., at Moscow. Estimated cost to exceed $1,000,000. Work will be done by day labor and technical aid contracts.

United Soviet Socialist Russia—c/o Amtorg Trading Corp., 261 5th Ave., New York, N. Y., will build a freight-car building plant, 5,000 cars annual capacity at Karzan. Estimated cost to exceed $1,000,000. Work will be done by day labor and technical aid constracts.

Equipment Wanted

Calif., Mare Island (Sta. Vallejo)—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until May 17 for motor driven sliding head drill machine for Navy Yard here. Sch. 7970.

D. C., Washington—Bureau of Supplies & Accounts, Navy Department—will receive bids until May 10 for two motor driven thread milling machines. Sch. 7950.

Mass., Boston—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until May 10 for one 75 ton and one 35 ton hydraulic forcing presses, for Navy Yard here.

Minn., Hastings—W. Willing, District Engineer, 615 Commerce Bldg., St. Paul, will soon receive bids for electric crane for lock and dam here.

O., Bexley—Board of Education, L. M. Krumm, Clk., 364 North Ardmore Road—will receive bids until May 16 for electric drill, metal and woodworking equipment, etc., for high school.

O., Toledo—Division of Purchase, Sales & Traffic, Department of Agriculture, Washington, D. C.—will receive bids until May 10 for combination brake relining machine and grinder here. Pro. 1616.

Pa., New Castle—Citizens Lumber Co., White St., Edward Wilson, Treas.—milling and planing machinery for 1 story, 80 x 150 ft. mill destroyed by fire.

Tex., San Antonio — Constructing Quartermaster, Camp Normoyle—will receive bids until May 20 for portable motor driven arc welding set and brake drum turning lathe, motor driven.

Ont., Kitchener—Wunder Furniture Co., 280 Victoria St. — interested in prices on woodworking equipment for plant destroyed by fire. Loss $100,000.